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THE

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CHAOTIC GROUPING.

IT is indeed difficult to discover by what line of reasoning, or chain of evidence, Mr. P. J. Pybus has been led to conclude that the cure for the present industrial indisposition is "payment by results," and it is still more difficult to comprehend by what mental process this conclusion has gained the support of *The Times*. Politicians, who of all men claim to be best informed with regard to the industrial situation, have just assured us that the trouble, immediate and prospective, is unemployment; and their plea for work for the workless has not gone unheeded. If this plea is well founded, and if it is made in good faith, the moment has arrived to concentrate upon ways and means for increasing employment, and in these circumstances the time seems singularly inappropriate for suggesting further interference, by outside bodies in the arrangements to be made between employers and employed.

Mr. Pybus informs the world that "labour in this country shows many signs of growing unrest," and, for the pacification of labour, payment-by-results is the familiar remedy which he proposes to administer. For a certain class of distemper his prescription would be excellent, as we have said again and again in these pages, but in the present instance how can it exert influence upon the disease? If the patient is dying from unemployment, complicated by what Mr. Pybus diagnoses as "chaotic grouping," this remedy has been selected from the wrong shelf. The cure for unemployment is work, and the cure for chaos is the restoration of the firmament.

As between employers and employed, is it quite certain that there are signs of "growing unrest?" That there is dissatisfaction between various sections of trade unions is common knowledge, but this is an entirely different matter, and must be carefully distinguished from the old succession of grievances between masters and men, or there will be chaotic grouping indeed. Hope to-day centres upon improved relationships within the industries, upon a clearer, broader, and more sympathetic outlook upon life, and the duties and responsibilities of all concerned. As a slogan in a campaign of goodwill "Payment by Results" may attract, but it can scarcely inspire. At the next stage it degenerates into the awkward question: How much pay for what results? And without a proper basis of faith in one another, there can be no just answer to that ever-recurring conundrum. It is an old story: New work arrives, a trial is made at time rates, costs are examined, a piece-rate is agreed upon and fixed, some produce twice as much as they did before, some a third more, some over-exert themselves and fall away, but at last the groups form and the shop takes up its stride. Then the order is completed, and if there is nothing to follow, what happens to payment-by-results? No results, no pay, that is all.

Analysis indicates that the best chance for the maintenance and development of the industrial life of the country is the avoidance of interference and of rigidity in these matters. At the moment, the main evil is unemployment, and it is to be feared that worse conditions in this respect are to follow. If, as the improvers of society appear to imagine to be the case, employers had a never-ceasing demand and a correspondingly profitable market for their goods, and if the goods were all of the same convenient kind to manufacture, all their well-intentioned methods could be adopted. It is

the gaps in the order book, the variety of the inquiries when they arrive, and the indifferent sales, that constitute the cause of the present trouble. The cry for high wages will shortly be followed by the request for employment at the price that will enable continuity to be maintained. An arrangement of this kind can only be entered into between employers and employed on a basis of mutual and friendly understanding.

There is just one other chance for struggling humanity. It is that the large and increasing body of politicians, lawyers, clergymen, novelists, journalists, psychologists, and other lovers of labour, who have so much to impart concerning the way in which masters and workpeople ought to act towards one another, and how factories, mines, and industrial undertakings generally ought to be operated, should form themselves into a Limited Liability Company, and demonstrate their principles. If they can give continuous employment, the country will bless them. If they fail, they may hold their peace, and thereby allow masters and men the much-needed opportunity to settle between themselves, as they have often done before, how best to tackle the difficult task the war has left them to complete.

Sir Lynden Macassey thinks the moment appropriate to acquaint *The Times* with the question of "demarcation." His opinion is that the "craft" system of Trade Union organisation has done more to impede the introduction of time- and labour-saving appliances into English industry than any other factor, and he holds that the "industrial" type has assisted, in the United States, in a superlative degree, to introduce such appliances, and to lower the cost of production.

Lord Askwith, whose experience in negotiations of this character renders his remarks especially noteworthy, has challenged the remark of Mr. Pybus to the effect that with the co-operation of the trade unions, by the simplification of the trade union system, and the institution of a general system of payment by results, there is real hope that the ability to sell the goods British industry produces in the open market might secure a new lease of prosperity. He declares that this indicates a sanguine optimism far removed from actual conditions. Moreover, he doubts whether the trade unions would enter into such an arrangement, and his doubt will be shared by many who remember the history of the last nine years.

The sanguine optimism to which Lord Askwith refers receives, as we write, a noteworthy comment from the official organ of the trade unions. The *Daily Herald* declares that "the Trade Union movement has definitely set its face towards a reorganisation that shall have regard solely to the interests of the workers as workers. No one can definitely say what the exact lines of this future organisation will be, but certainly they will be of such a character as will allow the workers in the various industries to 'control production' when the present system has passed away." In other words, the trade unions desire magnitude, though they are undecided with regard to direction, except that they seek solely for their own interests, and for the control of production. Thus also, in chaotic groups, lived for a dismal period the mammoths of the palæolithic age. And thus they grew, until their dimensions and outlook were such that their heads could not keep pace with their tails. They became useless until they became extinct, when their bones were regarded as objects of instruction and compassion, conveying in perpetuity the lesson of what happens to those who seek by magnitude without knowledge and without discipline, to control others before they can control themselves.

Our Electrical Imports from Germany.

The official figures recording the value of the trade done between the United Kingdom and Germany during the first half of the present year are worth noting. They may be considered in comparison with the figures for the complete year 1922, and the official view is that the difference in the general level of prices in the two periods was not very great. The imports into the United Kingdom from Germany were approximately £17,000,000 during the six months (say £34,000,000 per annum), as against 26½ million pounds for the whole of 1922. We exported our produce and manufactures to Germany to the value of approximately £21,000,000 in the six months (£42,000,000 per annum), as against £32,000,000 for the complete year 1922. The re-exports to Germany were also larger. This all-round increase, the *Board of Trade Journal* says, is either due to, or in spite of, "the renewed economic disturbances." When we examine the figures of our principal imports from Germany we find that in respect of electrical goods and apparatus there has been an increase in value and presumably of volume notwithstanding the disposition to limit our purchases to British manufactures. The imports of such products from January to June, 1923, are valued at £324,100 (or £648,200 per annum), whereas for the complete year 1922 the total was only £379,300. German machinery imported during the six months was £612,300, a figure which is not materially different from the rate for the year 1922, when the twelve months' total was £1,138,600. "Iron and steel and manufactures thereof" is one of the very few import items in which there was a decline, but the heaviest increase in our exports to Germany was in coal, iron, and steel, while "tops and yarns" fell off considerably—both features being closely bound up with the disturbance consequent upon the occupation of the Ruhr.

It may be of interest to mention that in the summary of electrical imports given in our issue of July 20th (p. 117), we showed that such goods coming in from all foreign sources for the month of June were £268,546, an increase of £66,065 over June, 1922. The imports of electrical goods and apparatus and electrical machinery during the first half of 1923 were valued at £1,659,136, as against £1,277,340 for the corresponding half of 1922, an increase of £381,796. Germany's share of the electrical goods and apparatus, as already stated, was £324,100. In our tabular statistics for the month of July given elsewhere in this issue it will be seen that the whole of the electrical imports (electrical goods and apparatus, electrical machinery, and cables) into the United Kingdom amounted to £201,479, a decrease of £67,067 as compared with the June figures. Probably the dockers' strike has something to do with this.

Laughter and Tears.

The holiday season is at its height; there is much bustle at the railway stations, fun and frolic at the sea or across the Channel, and restful quiet among the hills—but not everybody can afford a holiday in these days, and some who are in the trade slough of despond are asking where people get all the money from just now. The holiday-making throng, however, includes many anxious business men and tired women who are glad to get away from ordinary affairs, and after the change come back to face difficult situations with new health and courage. But there are too many who are every day faced with the difficult problem of unemployment—there is no going away and there is no coming back—it is always the same pathetic monotony and anxiety. There is no doubt therefore of the timeliness of an appeal that has been put before us to pass on to our readers, on behalf of unemployed ex-officers and men of similar standing. The urgent necessity for securing work for these men who have not had a fair opportunity since demobilisation of re-starting their civil career is a matter of great concern to the National Appointments Committee (Ministry of Labour and Officers' Association), and it should likewise be near to the heart of all of us. No words by way of argument are needed—the merits of the case are the basis for the appeal. It is earnestly desired that the problem may be solved without delay—if possible before the end of this year, notwithstanding official gloomy forecasts regarding the coming winter. We are glad to learn that the

number of ex-officers and men on the register of the Appointments Department has been reduced from 11,464 to 5,941 since the beginning of the year, and it is felt that notwithstanding the adverse conditions, a further satisfactory reduction can be secured if there be renewed and concerted effort to that end. We hope that those who are in a position to do so will lend a hand—it is really everybody's business, but some are in positions of authority where they can help, and it is to these we especially appeal.

Following up Overseas Inquiries.

There seems to be something radically wrong with the follow-up system of British manufacturers who need to be doing a larger export trade. Perhaps we ought to say *some* British manufacturers, for the criticism that has reached us from overseas does not apply to all—a number of well-known names are quoted as exceptions. We receive communications asking us to request our manufacturers to forward catalogues and price lists to buyers abroad—sometimes they represent electrical supply or other public works whose requirements are substantial, at others they may be foreign factors or agents who want to sell British goods. A few firms take immediate advantage of the opportunity—perhaps one in ten possibles; but as with the cleansed lepers—where are the nine? May-be they have "local" agents in the country from which the appeal comes, but surely that should not prohibit them from forwarding publicity literature which should assist their agent to secure trade on their behalf! It is suggested that if British representatives were thoroughly alert for business opportunities it should not be necessary for buyers to write home for lists, but distances are great, and centres far apart. It is stated that though British firms are represented, their names and addresses are unknown by potential purchasers even in the same class of business. We are not in a position to say how frequently this is the case, but one of the remedies that we can suggest is that the names of agents and their addresses should be more generally given in our advertisement pages, so that our overseas readers may know whether there is a representative of a given firm near at hand to whom they may apply.

But the criticism goes even further than the foregoing. Visitors who are most courteously treated at British Industries Fairs, exhibitions, and works, are promised catalogues which are "in preparation," on their return to their foreign or colonial post. When they reach their posts, however, they wait in vain for the arrival of such literature. Why is it? Let those who are responsible look into it and see that such promises are followed up. It is incredible that there should be weakness on the export selling side in these days. Each firm should take direct responsibility for its own publicity and follow-up operations and see that they are efficiently and promptly carried out. It is important to engineers in charge of electrical undertakings abroad that they should have at hand an up-to-date collection of British manufacturers' catalogues. Surely it is in the interests of the said manufacturers that the desire should be gratified!

Statutory Notices.

Under the earlier Electric Lighting Acts, the Post Office was entitled to notices regarding the intended execution of electrical work within 30 ft. of its lines, *except* in the case of services. By Section 25 of the Electricity (Supply) Act, 1919, this exemption was removed, and seven clear days' notice was required. Recently Post Office representatives have begun to claim notices under this Section, but are asking for "not less than 48 hours" instead of seven days. Whilst the reduction may be regarded as a concession, the necessity of giving notice will be irksome to station engineers. The laying of services cannot always be undertaken at leisure, nor does the work always proceed smoothly and systematically. In many cases it is not possible to work to plans drawn out three days in advance, without incurring unnecessary expense and inconvenience. Unless it can be shown—which we do not believe—that the interests of the Department have suffered materially from the non-observance of the rule in past years, there is no justification for its rigid enforcement, and we think the case would be reasonably met if the Postmaster-General's local representatives were instructed to accept such notice in advance of the commencement of the work as the supply undertakers in good faith and with the best intentions found it possible to give them. The undertakers would still remain accountable for any damage that might be caused due to their failure to comply strictly with the rule. To suppose that actual inspection of every service by a Post Office representative is necessary would be absurd, and such procedure would involve the Post Office in expense for which there would be no adequate reason; occasional inspections can always be made when the supply authority's men are laying services. In this, as in other matters in which no important principle is involved, a helpful and accommodating spirit tends to facilitate progress, and truly serves the public interest.

Hydro-electric Progress.

The opening of the hydro-electric generating station of the city of York, of which a description appears elsewhere in this issue, is a welcome indication that progress is being made in turning to good use a source of energy which makes no call upon our dwindling stores of coal, but derives its operation directly from the sun. There are in existence in this country far more hydro-electric installations than anyone unfamiliar with the facts would ever imagine; but most of them are of very small dimensions, and those devoted to the public supply of electricity are but few. The more notable examples are all supplementary to much larger steam-driven installations, a fortunate circumstance in respect of the fact that they can therefore be utilised to the full, so that in spite of the heavy initial outlay they are able to effect a marked economy in cost of production. For many years Worcester Corporation was almost unique in the possession of water-driven plant; more recently at Chester Mr. S. E. Britton harnessed the River Dee, and now Mr. E. J. Nichols has made use of the Yorkshire Ouse. In each case the undertaking is municipally owned, and the fall is of the low-head type.

Doubtless there are other water powers which could be similarly utilised, but it is notorious that any attempt to put them to service usually arouses a host of vested interests deeply rooted in past ages and particularly pugnacious. These difficulties are not met with in sparsely-populated areas and in "new" countries; hence many installations, such as that at Loch Awe, which is also described in this issue, have been carried out, with most successful results, in Scotland and Wales, affording the happiest solution to the problem of lighting, heating, and cooking in places far from the amenities of civilisation. A hydro-electric generator is the only type which can be left continuously running without attention and without waste, reducing running costs to the minimum.

With regard to new countries, the series of articles which we are publishing from the pen of Mr. W. T. Taylor, an engineer of exceptionally wide experience in the planning and construction of big hydro-electric installations and transmission lines in many parts of the world, should be of interest and value to those who are concerned with the development of the hydraulic resources of the Dominions and Colonies and of foreign lands, a vast field of enterprise which, we hope, will be largely cultivated by British engineers and manufacturers.

THE ELECTRIFICATION OF THE S.E. AND C. RAILWAY.

One of the most important schemes of railway electrification placed before the Trade Facilities Act Advisory Committee was that involving the suburban lines of the South Eastern and Chatham Section of the Southern Railway.

That the advantages of the proposals were recognised by the Committee was evidenced by its recommendation to the Government to guarantee as to principal and interest a sum of 6½ million pounds spread over a period of twenty-five years.

The accompanying map clearly shows how thoroughly the area within a radius of 15 miles of the London termini is served. The co-ordination of services on this network has been a triumph of railway organisation and it is evident that electrification will render this a great deal less difficult than it has been under steam traction. The new system will, in particular, improve conditions at the London termini—Victoria, Charing Cross, Cannon Street, and Holborn Viaduct. Under existing arrangements, locomotives bringing trains into these stations have to wait until the train is moved by an outgoing locomotive before they can get out and be turned for an outward trip. This involves a great loss of time and waste of power which double-ended electric trains will eliminate. This is quite apart from hygienic conditions which the disappearance of smoke will improve considerably. It will be seen from the map that lines which are to be electrified run through many important residential districts reaching to Croydon (Addiscombe Road), Hayes, Orpington and Dartford. These lines have a total route length of 94 miles, but the length of track represented (including sidings) is 210 miles. Later schemes, which are at present in abstract form only, provide for extensions to Gillingham, Tonbridge, Redhill, Dorking, &c., a further 140 miles of route.

The commencement of the work was delayed to some extent by difficulties arising over the choice of a system and the question of power supply. Each of the electrified portions of the other two main branches of the Southern Group has its own system. The London, Brighton and South Coast Railway operates upon high-pressure, single-phase alternating current collected from overhead trolley wires, while the London & South-Western branch utilises a third-rail conductor system working at 600 volts direct current. The system finally chosen for the South-Eastern lines is similar to the latter—660 volts direct current taken from a third-rail conductor with track return.

The question of the supply of power formed the subject of a protracted inquiry by the Electricity Commissioners last year. The inquiry revolved about two conflicting applications, one by the railway company itself for permission to erect a 60,000-kW station at Angerstein's Wharf, Charlton, and one by the West Kent Electricity Co., Ltd., for consent to the erection of a 150,000-kW station at Belvedere. During the proceedings the County of London Electric Supply Co. put in an offer to provide the necessary power for the electrified lines from its 100,000-kW station at Barking, the construction of which had already received sanction. The Commissioners expressed themselves as satisfied that the County of London Co. was in a position to afford a supply within the required time, and at a price as low as that at which the railway company could generate its own electricity. As the construction of the station by the West Kent Electric Co. was contingent upon the receipt of a contract for the supply to the railway company, this was abandoned, and eventually a contract was arranged between the railway company and the County of London Co. The latter has applied for an Order permitting it to supply energy to the railway company. A main receiving station is to be built at Lewisham Junction, and from there it will be transmitted to 19 rotary-converter sub-stations for feeding the third rail.

Map showing the Lines of the South-Eastern Section of the Southern Railway now being Electrified.

Two of the most important contracts have already been placed as mentioned in a recent issue. The English Electric Co., Ltd., is to supply five hundred and eight 300-h.p. motors, and the Metropolitan-Vickers Electrical Co., Ltd., has received an order for the control apparatus for 124 three-car train units and 59 two-car trailer units.

Mr. A. Raworth, electrical engineer of the S.E. & C. Section, is responsible for the work.

ELECTRICAL POWER SUPPLY IN THE NORTH AND NORTH-EAST OF FRANCE.

The Present State of Development.

The decree published on May 7th, transferring the control of the power supply network owned by the French State in the North and North-East of France to two companies—the Société de Transport d'Energie Electrique du Nord and the Société de Transport d'Energie Electrique de l'Est—and authorising the extension of the network to a number of towns in the devastated territories only partially supplied by the network already in existence, has brought developments in France to an almost final stage of completion. The supply companies operating in the North and North-East have joined forces to create the new companies and take over the State undertakings, with the result that something like unified control has been established or is in process of being established in the predominantly industrial regions of France. Two of the companies, at least, are connected with the iron and steel industry—La Houve and the Société Electrique de la Siderurgie Lorraine—the latter supplying the Compagnie des Forges et Aciéries de la Marine et d'Homécourt, La Société des Aciéries de Longwy, the Aciéries de Hombar, La Société des Hauts Fourneaux et Fonderies de Pont-à-Mousson, and other important companies located at Thionville, Komtange, Ledange, Defferdange, Aussetz, and Briey. Such centralisation of control, corresponding to the centralisation already carried out in the iron and steel industry, must lead to improved organisation for production and ultimately greater competitive power.

The following table illustrates the position in detail. In some stretches, notably between Mohon, Landres, Conflans, Nancy, and Delle, the pressure of transmission has been rated at from 100,000 to 120,000 volts, but the present working pressure does not exceed 70,000 volts. The length of network, 4,039 kilometres, or 2,525 miles, is slightly less than half that of the whole of France—8,849 kilometres, or 5,530 miles:—

Supply company.	Power stations. Name.	Capacity (kW).	Transmission network (high pressure). Length (kilometres).	Main towns connected.	Voltage.	Output, (average annual) million kWh.
North.—						
Société Electrique du Nord-Ouest	Bully	32,000		Calais		
	Labuessière	19,000		Boulogne		
	Beuvry	32,000		Arras		
	Isbergues	17,000	500	Abbeville	45,000	70
	Calais	2,000		Amiens	(100,000 later)	
	Amiens	4,500		St. Omer		
	Abbeville	22,000		Dunkirk		
	Marles	(Under const.)				
Réseau d'Etat (Société de Transport d'Energie Electrique du Nord)	Somme	20,000		Somme		
	Vendin	54,000		Valenciennes		
	Valenciennes	20,000	800	Douai	45,000	80
	Jeumont	18,000		Cambrai		
	Beautor	18,000		Jeumont		
	Rheims	10,000		Rheims		
	Mohon	16,000		Herson		
	Bully & Beuvry					
Energie Electrique du Nord de la France	Comines	85,000	318	Comines	45,000	65
		(115,000 projected)		Wasquehal		
	Wasquehal	56,000		Tourcoing		
				Roubaix		
				Lille		
East.—						
Compagnie Lorraine d'Electricité	Nancy	17,500	210	Nancy	65,000	120
	Vincey	40,000		Pouneux		
				Viterne		
				Delle		
Réseau d'Etat (Société de Transport d'Energie Electrique de l'Est)	Vincey	—	217	Conflans	65,000	—
	Nancy	—		Jarny		
	Mohon	—		Amanvillers		
				Laon		
				Briey		
La Houve Société des Mines et d'Electricité	Creutzwald	25,000	350	Fontoy	65,000	—
				Schirmeck		
				Amanvillers		
Société Electrique de la Siderurgie Lorraine	Iron and Steel Works Stns.	120,000	—	Principal iron and steel works of Lorraine	65,000	—
Société Alsacienne et Lorraine d'Electricité	Creutzwald	—	460	Sarrebruck	65,000	90
	Millery	—		Sarrebourg		
	Markslakeim	—		St. Blaise		
Electricité de Strasbourg...	Strasbourg	39,000	950	Strasbourg	70,000	50
				Haguenau		
				Holsheim		
				Sarkheim		
Société des Forces Motrices du Haut-Rhin	Mulhouse	42,000	150	Colmar	70,000	100
	Kembs	55,000		Haut-Rhin Dept.		
	(projected)					
Société des Forces Motrices de la Loue	Mouthier	—	42	Pontarlier	60,000	20
				Mouthier		
				Besancon		
Société des Mines de Louekamp	Ronchamp	7,500	32	Belfort	52,000	—
	Etapis	3,000		Ronchamp		
	Boulois	8,000		Le Boulois		
Total Power and Length of Transmission	900,000 (approx.)		4,039 kilometres	Output.	800 million kWh (approx.)	
Total Length of H.P. Transmission for France			8,849 "			

THE CARBON ARC AS A STANDARD OF LIGHT.

By N. A. ALLEN, M.Sc. (Eng.)

The problem of obtaining a primary standard of light for photometric work has long occupied the attention of experimenters, and yet it cannot be said that any of the recognised standards are absolutely satisfactory. A standard of light must be such that under given conditions its candle power is always the same; it must not vary with time; and its light must be of approximately the same colour as that of the illuminants against which it will be calibrated.

The susceptibility of flame-standards (such as the pentane and amyl acetate flames) to draughts and atmospheric conditions (temperature and pressure, and the moisture or carbon dioxide content, for instance) militates seriously against their use, while the cost of

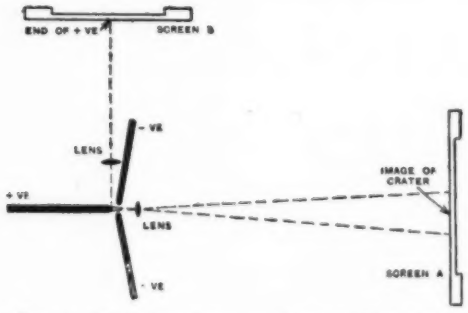

Fig. 1.—Y Arrangement of Carbons (Forrest).

platinum renders it less accessible for general use. One of the most promising methods of maintaining a uniform incandescent surface at low cost is by means of the carbon arc, in which the positive crater may, under certain conditions, be made to give a perfectly uniform illumination whose candle-power is easily calculable.

The ordinary electric arc with two carbons in line is known to be quite useless as an accurate standard for a number of reasons, of which the following are among the most important:—

1. The source of light itself, the positive crater, cannot be viewed directly. Moreover, it is indefinite in shape and varies considerably with time, with corresponding changes in illumination.

2. The presence of fumes and carbon vapour may interfere seriously with the light.

Experiments undertaken with the Y arc, first used by Forrest,* however, show that these disadvantages disappear with this arrangement of carbons (see fig. 1).

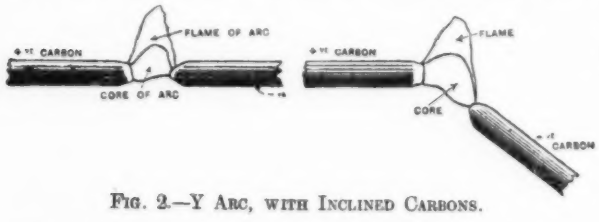

Fig. 2.—Y Arc, with Inclined Carbons.

The crater forms on the end of the positive carbon at right angles to the axis of the carbon, and is unobscured by the negatives; thus a circular uniformly-illuminated surface is seen, enabling photometric measurements to be made with great ease and accuracy. It was found by Forrest that the candle-power per square millimetre of crater area is a constant, and in the case of 6-mm. diameter high-grade carbons equal to 172 candles per sq. mm. In order to establish some relationship between the total light emitted by the arc crater and the factors under the influence of which the light varies, an attempt was made to find a connection between the crater area and the current and voltage of the arc. Some preliminary work was carried out with 6-mm. solid carbons,* and later with 11-mm. solid carbons, from which some interesting results may be deduced.

In a paper read before the Students' Section of the Institution of Electrical Engineers on February 3rd, 1922, it was shown by the author that, under the conditions which were always imposed for the Y arc, the relations between the illumination of the arc, its current, voltage, and crater area may be expressed very simply in the form of equations.

Conditions of Running the Arc.

A special apparatus was constructed, in which the negative carbons were arranged on either side of the positive and at an agle of approx. 130 deg. to it. In order to compensate for the bending upwards of the arc, which would cause an oblique crater, the negatives were also inclined up towards the positive from below at an angle of 45 deg. This is illustrated in fig. 2. The arc was so regulated that it ran with perfect steadiness and silence at all currents, this being effected by altering the length of the arc. Under these conditions a truly circular flat crater formed on the end of the carbon, which tapered down automatically to the shape illustrated in fig. 3, which shows an assembly of projections of the carbon on screen B (fig. 1).

Hence the crater area could be easily measured by the projection on screen A.

Relations Between Various Factors.

(*a*) *Variation of voltage across arc.*—It was found that for a given size of carbons the voltage across the

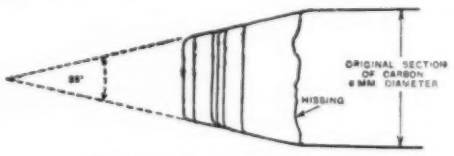

Fig. 3.—Elevation of Carbon.
Currents: 4.5; 4.8; 6.0; 6.5; 7.0; 9.0; 12.0 amperes.

arc was the same for all currents. This may be explained by the fact that the correct length for silent operation was directly proportional to the current.

(*b*) *Variation of crater arc with current.*—A typical series of readings is shown in fig. 4, demonstrating the fact that the crater area is directly proportional to the current for a given size of carbons. In other words, as shown in fig. 5, the current density is a constant, although different for different sizes of carbons.

If S = area of crater in sq. mm.,
I = current in amperes,
D = current density in amperes per sq. mm.
Then S = 1.340 I,
and D = 0.746 amp. per sq. mm. for 6-mm. carbons,
S = 2.262 I,
and D = 0.442 amp. per sq. mm. for 10-mm. carbons.

(*c*) *Relation between candle-power and current.*—Since it has been conclusively proved by Forrest that for the Y arc the intrinsic brilliance of the crater is uniform and equal to 172 candles per sq. mm., and since it has now been demonstrated that the total crater area is equal to the current multiplied by a constant, it is obviously correct to say that the total candle-power is equal to the current multiplied by a constant.

* *Electrician*, 1913, Vol. LXXI, pp. 729 and 1007.

* *Proc.*, Phys. Soc., Vol. XXXIII, Part 2, p. 62, 1921.

Thus, if L = total illumination, candles,
S = area, sq. millimetres,
I = current, amperes.
Then S = 1.340 I,
and L = 172 S,
Hence L = 232 I for 6-mm. carbons.

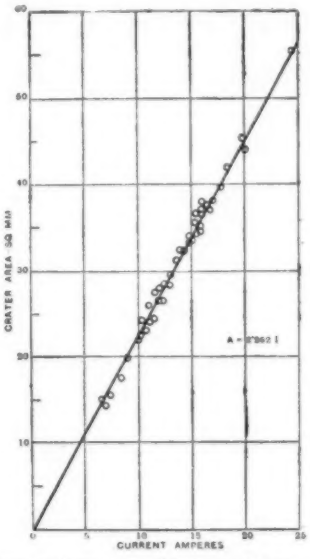

Fig. 4.—Crater Area and Current (10-mm. Carbons).

The importance of this relation is considerable, since we have in this modified Y arrangement of the arc a method of obtaining a uniform, steady, and high-power photometric standard whose candle-power is equal with an accuracy of about 99 per cent. to the product of the current and a predetermined constant. The only variable which has to be considered is the current, there being no voltage regulation necessary. The standard is unaffected by changes of atmospheric conditions. Its accuracy is at least as high as that of other primary standards, and, besides being quite easy to handle, its cost is so low as to render it the most promising primary standard of light within the reach of the photometric experimenter.

In conclusion, the author wishes to acknowledge his indebtedness to Prof. J. T. MacGregor-Morris, who first suggested the relation between candle-power and current which has been demonstrated.

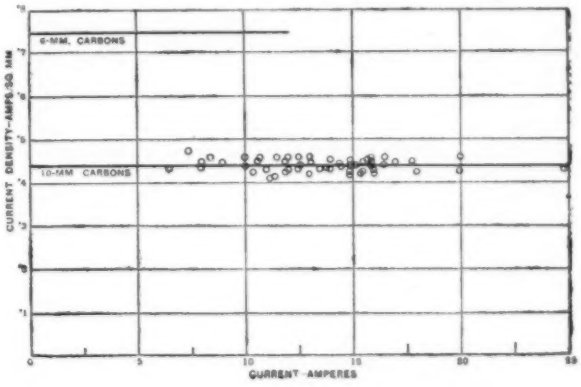

Fig. 5.—Current-Density and Current.

BETWEEN THE COST AND THE CATALOGUE.

BY J. O. KNOWLES, B.A.

In works producing mainly "catalogued" products, prices are likely to be stabilised for considerable periods, without regard to the variations in the cost of production of successive batches. When the time comes for a revision of catalogue prices, either on the issue of a new catalogue, or on varying the discounts in force, it becomes necessary to relate costs and prices very carefully. Up-to-date cost figures will show that at present market values, material costs so much per unit, and at present wage rates, labour costs so much. From a costing viewpoint, the data required for repricing is complete. Probably, however, only half the total cost of production is accounted for by the material and labour costs. The prices of standard products, produced in fair quantities, may have to be more than double the total of material and direct labour, to cover the cost of the organisation required for the economical production and sale of a wide variety of goods. The amount of "overhead allowance" included in each price is often therefore more important than the material and labour costs put together. Several methods may be used in fixing overhead percentages, all based on good logical reasons, but resulting in widely varying prices. No wonder that two firms, having similar equipment, can quote such divergent prices for the same article!

But for the purpose of the present article we may even assume that a summary of all overhead expenses over a recent period is available, and that a division of these has been made so that on each departmental labour cost, on material, and on the sum total of all other costs, a reasonable proportion of "overheads" can be charged. Prices can then be set out which are based on cost, as truly as the complete cost can be ascertained. It does not follow that these are the prices which should be charged.

Because overhead expenses do not increase directly with the turnover, the expected output is a big factor in pricing. It is not very difficult, from past experience or from process of reasoning, to put down safe figures for the necessary expenditure on materials, labour and overhead expenses under various headings for different volumes of turnover. On these figures a turnover below a certain figure will show a loss, and above that, a profit. If the overhead burden (and the selling prices) are based upon a turnover estimated to yield neither profit nor loss, there is small chance of making a profit unless this turnover is exceeded. On the other hand, if prices are cut to obtain a bigger proportion of business, and this bigger proportion does not materialise, the last state is worse than the first. There comes a point when the acceptance of more orders at reduced prices only increases the loss. A little table showing the estimated costs of producing various volumes of output with columns showing the expected profit for these turnovers at present prices, and at, say, 5 per cent. reduction, is a useful reminder of the danger of using the weapon of price-cutting overmuch to meet competition. It is a double-edged weapon.

It is not reasonable to expect that all classes of product should produce the same return of profit. Some types are worth making only because they help to carry some of the overhead burden, and do not cost more than their share of office time and other expenses. Other catalogued goods may have to be sold at cut prices, because more remunerative business depends on the acceptance of these orders. Sometimes an old design must be sold at a low price until an opportunity occurs of lowering its production cost by remodelling it. And since it is always easy to cut prices, the opportunities of obtaining a larger margin of profit on certain lines

should not be missed, provided that the future is safeguarded, as it will be if the customer is satisfied that the service he obtains from the product is worth the price asked.

It is unsafe to play with prices, basing them on guesswork, the mood of the moment, or competitors' prices. The modification of prices to meet selling conditions, as suggested above, is only safe when a price has already been set down, which actually contains a margin of profit which can be considered to be an average of what may be expected on the whole turnover, if the forecast of output volume is correct. Once this price based on cost is set down in black and white, it serves as a basis of reference. The effect of raising or lowering the price can then be considered in relation to the total margin of profit. If the output of a certain article is small, a considerable divergence from its "price on cost" will make little difference to the whole. On the other hand, in considering even a slight alteration in the price of a "bread and butter" line, the effect on the total turnover and the total margin for profit must be closely watched. Generally, before it is safe to alter such a range of prices, there must be evidence of permanent alteration in material, labour or overhead cost, or else a sound expectation of greater turnover.

To make sound practice of such a policy of compromise between costs and market conditions, there should be kept some record of the data on which price lists have been based, this record being in such a form that at a later date it is easy to compare actual costs with these previous data, and to compare actual market conditions with those which determined the former divergences from the "cost basis prices."

ELECTRICITY SUPPLY AT GLASGOW.

Report for the Year 1922-23.

We have received from the engineer and manager of the Glasgow Electricity Supply Department (Mr. R. B. Mitchell) a copy of the annual report upon the undertaking for the year ended on May 31st last.

This records a total income from all sources of £1,033,602, which was rather less than that of the previous year (£1,191,438). The working expenditure, however, fell to a greater extent—from £739,481 to £557,330, and the gross profit was in consequence greater, £476,272, as compared with £451,957. The lower expenditure was due to reduced generating costs, one noteworthy item being that showing the cost of coal, &c.; this fell from £235,643 to £123,696. The overall generating costs at £199,716 were about £144,000 lower than in the previous year. One or two items, as management expenses, were higher, but the amount written off for depreciation of plant was some £39,000 less.

The profit and loss account shows that the net profit for the year was only £9,507, as against £42,578 in 1921-22. This is accounted for by the larger amount transferred to sinking fund, this item being £199,632, or £55,280 higher on account of the commencement of the repayment of a loan of £1,382,000. The other items in the account remained at about the same level as in 1921-22.

The sinking fund account balance was £1,496,200; a balance of £69,067 was shown in the reserve fund; and £16,996 of the reserve fund was shown as invested.

The capital account records an expenditure of £707,812 during the year, some of the principal items being: Machinery and plant at Dalmarnock, £185,084; land and buildings for Dennistoun sub-station, £25,509; machinery and plant for this sub-station, £10,445; Kinning Park sub-station, land and buildings, £8,486, machinery and plant, £34,495; machinery and plant at Elliot Street sub-station, £12,303; machinery and plant at Buchanan Street sub-station, £10,979; machinery and plant at Govan sub-station, £10,720; mains and cables, £234,968; meters and indicators, £19,611; transformers in consumers' premises, £12,813; and cookers for hiring purposes, £6,245. The total amount borrowed reached the figure of £6,871,478, and the amount outstanding on May 31st was £5,302,429.

The energy sold amounted to 141,919,196 kWh, as compared with 131,341,783 kWh in the preceding year. The maximum demand rose from 173,272 kW to 180,490 kW.

The report states that there was a noticeable increase in the number and variety of appliances installed in domestic and business premises. In domestic premises there were over 21,000 appliances, equivalent to a demand of 19,700 kW, and in business premises over 11,000 pieces of apparatus, equivalent to a demand of 15,800 kW. The total number of motors in use was 16,498 (136,981 h.p.), as against 15,981 (134,532 h.p.) in the previous year.

The fifth set at Dalmarnock was put into commission during the year, completing the first half of the works and bringing the capacity of the station up to 93,750 kW. Specifications have been issued for a further two turbo-alternators, eight boilers, and the necessary switchgear. During the year the Alexandra Parade, Buchanan Street, Cadogan Street, Craigton, Kinning Park, Mosspark, and Polmadie Road substations commenced running, and the following were in course of construction: Bridgeton, Hawthorn Street, Langside, and Virginia Street.

A total of 5¼ miles of low-pressure feeders, 5 miles of high-pressure feeders, and 5¼ miles of distributors were laid on the north side of the Clyde, while 3¼ miles of low-pressure feeders, 8¼ miles of high-pressure feeders, and 13 miles of distributors were laid on the south side.

Notwithstanding an anticipated increase in costs, the Electricity Committee recommends that the present low scale of charges remain in force.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Ellison "Mill" Type Circuit Breaker.

Mr. George Ellison, Perry Barr, Birmingham, has put on the market a re-designed pattern of totally-enclosed, "free"-handle, magnetic blow-out automatic circuit breaker for use in mills, factories, workshops, and non-gaseous mines, to control and protect distribution circuits and motors. The breaker is fitted with one handle only, which suffices for closing and for quick-break hand release. The breaker parts are contained in a heavy cast-iron box, with a cover over the front to give access to the interior, and a cover suspended from the underside to protect the trip adjustment and time lag devices. The covers have packed joints, and, with the cable entrances properly closed, the whole is dust-tight and weatherproof: a stream of water may be directed upon it from a hose without risk of injury.

The current-carrying parts are mounted on steel rods covered with mechanically reinforced "Bakelite" insulation. The

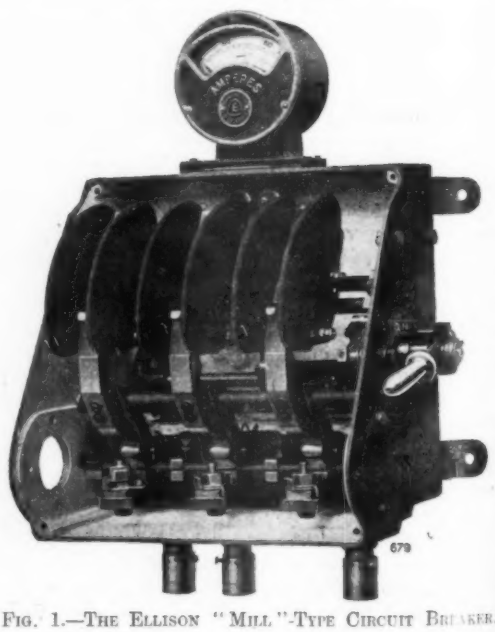

Fig. 1.—The Ellison "Mill"-Type Circuit Breaker.

magnetic blow-out coils are series connected and are fitted to both a.c. and d.c. breakers. The magnetic field is set up between cast-iron cheeks which are vitreous enamelled to serve as fireproof insulating barriers between the poles. The arc formed between the spark contacts is enclosed between the cheeks, and is controlled by the magnetic field throughout its length, thus ensuring the maximum breaking capacity. The disposition of the contacts and the design of the magnetic system were determined on the results of exhaustive research which gave data enabling the makers to state definitely the circuit-breaking capacity in amperes at various voltages. The breakers are made in single-, double-, and triple-pole patterns, with all the usual overload, no-voltage and other automatic

features, adjustable time lag devices and interlock arrangements, as shown in fig. 1.

The automatic tripping mechanism is very sensitive, the breaker is released with certainty on overloads and when the voltage fails suddenly or gradually. The no-volt plunger is actuated by a spring held in compression when the coil is energised. This spring is sufficiently strong to release the breaker even if the voltage falls off slowly, and the arrangement has the advantages that the plunger does not require raising by hand, as in some types of breakers; the tripping devices can be permanently enclosed as a protection against tampering; and it lends itself to electrical interlocking with motor starters or other gear.

The circuit breakers are made in three sizes which are determined by the size of cable that can enter the cases and be connected to the terminals. This is a departure from the standard practice of rating breakers arbitrarily according to the current that they will carry at reasonable temperatures. Cable entrances to the breaker box are provided at either side, and cone clamps, sealing or dividing boxes are supplied by the makers for any class of cable. Ammeters can be mounted on the breakers if required, and the breakers may be supplied with lugs for bolting to walls or with stands for erection on floors.

A Thermostatic Relay Switch.

A new type of switch for the thermostatic control of motors, electric heating units and other electrical units is being marketed by the Minneapolis Heat Regulator Co., Minneapolis. The device, fig. 2, is stated by the manufacturers to be a double control switch providing a low-voltage circuit to the thermostat operated at 7½ V, taking less than 15 W. The

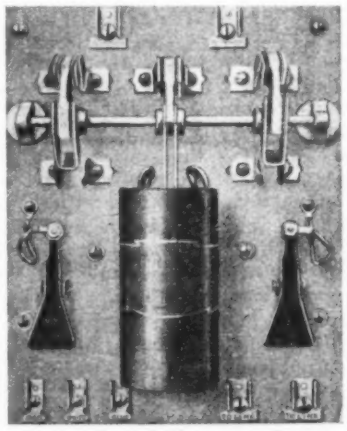

Fig. 2.—Thermostatic Relay Switch.

power for this low-voltage circuit is provided by a transformer built integrally into the relay. The thermostat on temperature changes selectively energises two low-voltage magnets which in turn energise 110-V solenoids closing or opening the main line circuit to the motor or other apparatus to be controlled.—*Electrical News* (Toronto).

A New Method of Preserving Eggs.

A new machine for treating eggs with a preservative solution quickly and efficiently has recently been developed by a San Francisco firm. The machine is simple in construction and is easy to operate. The eggs are placed in a basket, which is then drawn into a tank filled with a vegetable oil maintained at a temperature of approximately 200 deg. F. The tank is 36 in. long by 24 in. wide. The eggs are entirely immersed in the oil for a period of about 30 seconds, and are then removed and drained. The cooling of the oil fills up the pores in the shells, which prevents air from getting into the eggs and spoiling them. The oil in the tank is heated by eight 500-W, 24-in. Westinghouse space heaters with an automatic temperature control consisting of a thermostat and a motor-operated snap switch. The equipment is illustrated in fig. 3.

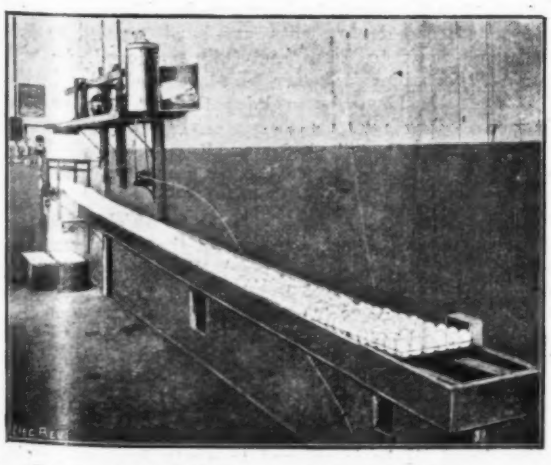

Fig. 3.—A New Method of Preserving Eggs.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Trade Outlook in China.

China at present is in a most chaotic condition, which appears to get worse and worse. Many parts of the country are over-run with bandits, causing great interference to the main trade routes, and the condition in China generally is such as to call for drastic action to protect legitimate trade interests, both Chinese and foreign. If China would only put her house in order there is a wonderful market for electrical developments. The Chinese appreciate the advantages of electric light, and what would be considered a well-lit house in England would not be brilliant enough for the Chinese household; high candle-power lamps and plenty of dazzle are the order of the day. By electricity supply companies great enterprise is shown In a small town a company will install an old second-hand steam-driven set—no reserve, no spares—and will supply current for lighting. The h.p. lines at, say, 2,000 volts are run on weak-looking poles, with much less care than would be bestowed on a telephone line in England. Wiring rules are unknown, also a megger, &c. Should the voltage drop be excessive a lower voltage lamp will answer. In one town of which I know, lamps of six different voltages could be obtained, and during the evening, when the full load was approaching, the householder or shopkeeper would change his lamps.

At the present time China has no government, no president, no premier; business and progress are at a standstill, and no great advancement can be made till this unhappy country is freed of the militarism that has over-run the land. The militant party has been the curse of China, for it is unscrupulous to the extreme. China is at present a decadent and helpless nation, camouflaged to represent a great progressive country by her representatives abroad and the hoodwinked foreigner residing at treaty ports. To-day there is no such thing as a government, either civil or military, and there is evidently no control of either the army or the people. The whole of the vast empire is in a state of chaos, both financially and morally, and, until order and peace once again reign, the trade outlook is extremely poor.

Observer.

China, *July 7th*, 1923.

Electric Vehicle Progress.

On page 191 of your issue of the 3rd instant is an interesting note showing the steady progress which is being made in the field of electric vehicles. The paragraph in question refers to the recent orders obtained by one battery maker, while a further examination of the position would disclose the fact that at least equally satisfactory demands are being executed by the other firms which cater for this class of business.

I would at the same time like to call your attention to a rather serious mis-statement to the effect that only one company provides a regular and skilled service inspection, and would point out that, on the contrary, this policy has been adopted for many years by all the important firms engaging in vehicle battery business. It is, in fact, rather unfortunate that there has perhaps been a tendency to overdo the service business, for the sake of the valuable information which is thereby made available to the manufacturer, both in regard to the performance of his batteries and the possibilities of further business. In many instances, the battery user has expressed an opinion that the persistent visits of these inspectors indicate considerable nervousness on the part of the battery manufacturer as to the ability of his product to meet everyday working conditions without special nursing. I would, therefore, strongly suggest that, excellent though this service may be, it would be of advantage to the industry if not quite so much attention were called to it.

L. Murphy.

Westminster, *August 13th*, 1923.

A PLANNING PURCHASING SYSTEM.

By W. J. HISCOX.

Whilst individuality is a strong point with the present-day buyer, this must be exerted in a manner calculated to confer the maximum benefits upon production as a whole. There are so many interests dependent upon the policy of the buyer that that policy must be framed in such a way as to embrace them all, so that no detail is overlooked, and no claim ignored.

Buying for an engineering factory necessitates a thorough knowledge of actual manufacturing conditions, for the requirement of the factory must be catered for and every endeavour made to give satisfaction. The low-priced article is not necessarily the cheapest, nor does it follow that the expensive and superfine material will yield the best results in all circumstances. The precise circumstance must be catered for, and this means due consideration being accorded the claims of both the manufacturing and the costing departments.

The latter department is, of course, concerned with the total cost of the detail (*i.e.*, material plus wages), whilst the manufacturing department is concerned only with its own labour costs. It follows, therefore, that this department will press for the best material, in order to minimise its own working costs, but unless these costs are reduced at least proportionately to the increased cost of material, the costing department must necessarily declare the policy uneconomical.

From this it is evident that the closest association must exist between the buyer and the manufacturing department, though the former must not in any degree be subservient. Whilst he is prepared to meet the wishes of the manufacturing department, he must know that those wishes are not only practicable, but economical also, seeing that interests other than those of the department are involved.

Many schemes have been devised for ensuring co-operation between the buyer and the manufacturing departments, but for the purposes of this article one has been selected which has proved successful in a large factory engaged in the manufacture of electrical equipment. The lines involved, which for our purposes may be called A, B, C, and D, are so diverse in construction that no details are stocked in a finished state, and an order received for one, two, three, or four units means that every detail involved must be specially manufactured.

Whilst many of the details can be manufactured from standard steel or brass bar, which allows for the stocking of these materials in bulk quantities, others have to be specially ordered, either in a raw or a finished state; and the quantity in each case being small, it will be appreciated that purchasing is a somewhat intricate business. The decision whether the detail shall be purchased in a raw or in a finished state must be made in respect to every order, and this suggests the close application of the practical man.

It is obvious that the buyer cannot take the initiative without practical assistance, and bearing in mind the volume and diversity of the work, there being no fewer than four distinct lines of manufacture, in connection with each of which there are scores of orders always on hand, a strong organisation is imperative. This takes the form of a combined planning and purchasing department, which may now be described.

The department is divided into sections, four of which are reserved for the different lines of manufacture (classified A, B, C, and D). Each of these sections is controlled by a practical engineer, who combines the duties of planner and buyer, and who is responsible to the head of the department. His business is to receive an advance specification, determine which of the details shall be manufactured in the factory and which shall be purchased outside, and, in the case of the latter, to send out the necessary inquiries for quotations, place the requisitions, follow up, and keep all records. If the volume of work demands, he has the assistance of one or more clerks, the work being subdivided so that each clerk has definite responsibilities.

The remaining section is purely clerical, and is responsible for the issue of master orders in respect to the details to be manufactured in the factory. This section is in charge of a routine clerk, who receives instructions from the four section leaders already described, and contains four sub-divisions in accordance with the different lines of manufacture handled.

Advance detail specifications are issued from the drawing office, and these are received by the section leader interested. A copy of the official order is in his possession, and the delivery date given thereon has an important bearing upon his decisions. There are, of course, certain details which must of necessity be purchased from outside sources—such as proprietary articles and materials which cannot be handled in the factory—and these are speedily dealt with. Other details, however, can either be manufactured in the factory or purchased outside, and it is in regard to these that consideration must precede the decision.

Many factors must be taken into consideration. Although the detail may be to a new design, it is quite possible that it is somewhat similar to a detail already handled, in which case a precedent has been established, which might be followed with advantage. But before action is taken, the previous circumstances must be recalled, for it may be that, at that time, the decision to order the detail from outside was due to the extreme pressure of work in the factory. On the other hand, whilst previously the part was handled in the factory, present-day conditions, taken in conjunction with the delivery date of the new order, may render it advisable for the manufacture of the detail to be handled outside. Before a decision can be reached, therefore, the section leader must be in possession of up-to-date facts concerning factory conditions, and view these from the standpoint of the delivery date of his order.

Generally speaking, the factory has precedence over the outside supplier, on the principle that it is the better policy to allow the factory to handle all that it possibly can. The section leader's first thought, then, is for the factory, and, assuming that shop conditions are favourable, his next consideration is the cost. While his creed is that, if the factory cannot produce as cheaply as can the outside supplier (the utility of the article in each case being equal), the order must go to the latter, circumstances may again tend to qualify this. If there is plenty of work in the factory, the section leader does not hesitate to place his order where he can reap the greatest advantage, but if certain of the manufacturing departments are hard pressed to find sufficient work to keep them fully employed, he will probably consider it better to place the order in the factory, even though by so doing the cost of the article is increased.

Again, too, the relatively small quantities call for consideration in determining whether the part shall be purchased in a raw or in a finished state. Assuming that the part in question is a forging, which must subsequently be machined, it is evident that (if there is no smithy attached to the factory) the forging must be purchased from outside. But it may be that the outside maker has a machine shop, and he would rather supply the part completed. To achieve this end he would probably put a high price upon the roughing operation, and although by so doing he runs the risk of losing the order altogether, he is not particularly keen upon retaining such a small order for one operation only. On the other hand, if he is allowed to quote for the finished part, the result will, in all probability, be quite

satisfactory to the buyer, the total cost being below the quotation for the forging, plus the machining costs incurred in the factory.

Immediately the decision is reached in respect of the details to be purchased from outside, no time is lost in sending out inquiries for quotations, or, if these are unnecessary, in placing the requisitions. There is no need to await the arrival of the official specification (it will be remembered that the section leader is now handling an advance copy), for by so doing much valuable time would be lost. It must be borne in mind that the outside supplier cannot be hustled as can the factory departments, for he is outside the control of the factory officials, and, apart from this, raw supplies must be delivered before the factory departments can commence manufacture.

The outside purchases having been determined, the remaining items on the specification list have to be routed; that is to say, the departments to handle the various phases of manufacture must be agreed upon. As, however, the section leader is concerned with but one line of manufacture, his choice of departments is limited, in the sense that there is, in all probability, one department set apart for that class of apparatus.

As there is a foundry attached to the factory, it is, of course, obvious that all castings must be routed from this department in the first instance, although, if no pattern is in existence, instructions for the making of this must be the first consideration. The drawing of the piece should show whether or not a pattern is in existence, and, if so, whether this is ready for immediate use, or whether any modification is necessary.

There are equally obvious departments for the handling of other details, such as pressings, tinsmiths' work, and the like, and such work is placed outside only when the factory does not boast of such departments. Excepting in the case of the foundry, every item to be manufactured in the factory is routed, in the first instance, from the store or from outside, according to the method employed for dealing with raw supplies.

Practically all machining is handled by the department associated with the specific line of manufacture; that is to say, the parts comprising the unit classified "A" being machined in "A" department, and so on. Exceptions to this happen when departments are reserved for specialised operations—as an example, there may be one department for handling all gear cutting, no matter for what class of apparatus it may be required. Although the precise operations are not determined by the section leader (this being the business of the department rate fixer or planner), the departments appear upon the specification list in the order interested, so that, should a detail, after being partially machined in "A" department, have to go to the gear-cutting department (G), and then return to "A" for finishing, the routing upon the list would read as follows, *viz.*, A, G, A.

The department letters (or numbers) having been entered upon the specification list in the columns provided, the advance copy is returned to the drawing office. It is now possible to determine how many copies of each sheet are required, it being understood that a sheet must be sent to every department directly concerned. The specification may comprise a dozen sheets, and this means that complete sets must be issued to each of the following departments, *viz.*:—Planning-purchasing, progress, stores, and the manufacturing department responsible for the product (*e.g.*, "A"). The other departments receive only such sheets as immediately concern them; for instance, items from the foundry appear only upon sheets numbered 1, 2, 6, and 10, whilst items from the gear-cutting department appear only upon sheet number 4. The copy sent to the foundry, then, would comprise four sheets, whilst that issued to the gear-cutting department would consist of one sheet only.

All copies of the official specification may be distributed by the drawing office or sent in bulk to the planning-purchasing department for distribution, whichever procedure is deemed most convenient. At all events, we may now assume that each department interested has a copy of the specification, and that all requisitions for outside purchases have been placed. The next procedure is to issue the master orders to the various manufacturing departments, these being handled by the planning-purchasing department in the section known as the order-issuing section, which has already been referred to.

Each master order is made out in duplicate, the "flimsy" copy being retained in the section for reference. The order merely gives the quantity required, drawing number, name of part, and specification item number, no mention being made of the operation, except in the case of a specialised department (*e.g.*, gear cutting). In regard to the quantity, it may be the rule, so far as the smaller details are concerned, to allow a certain percentage over and above the quantity shown upon the specification, with a view to obviating the necessity for manufacturing replacements for scrap. As each master order is made out, the serial number is entered upon the specification against the item covered, together with the date of issue; as the "flimsy" copies are filed in consecutive order they may be easily referred to later if necessary.

The master orders are sent to the departments concerned, and from these the necessary operation work cards are made out by the rate-fixer attached to the manufacturing department. Although a certain detail may be machined in its entirety in one department, it may be that several operations are involved (*e.g.*, turning, milling, drilling, &c.), and this part of the business, together with the fixing of rates, devolves upon the departmental rate-fixer.

When once the master orders have been issued, the planning-purchasing department evinces no further interest in the details being handled in the factory. The delivery date is known to the progress office, and this department is responsible for manufacture being completed to time. The progress man is, however, responsible for the completed product, and this means that he must not leave out of his calculations those details which are on order with outside firms. The section leader in the planning-purchasing department is, of course, primarily responsible for these, and he must have an efficient "follow-up" system which will not only ensure adequate attention being given to all outstanding parts, but which will also show the progress man what is being done and when the parts in question may be expected.

It is the progress man who can the more accurately determine the effect upon the delivery date of the product by a delay in respect of outside parts. The supplier may advise that the detail will be a few days behind the date promised, and to the section leader this delay appears trivial. By the progress man, however, the significance is more fully appreciated, for failure to get the detail by the date promised may dislocate the shop's programme to such an extent that the few days' delay in receipt may mean a week's delay in the completion of the unit. If the progress man is not aware of the probability of delay, he cannot revise his programme to meet the changed conditions; and in order that he may have every facility for guarding against delay (so far as the completion of the unit is concerned) and also to obviate the necessity for constant inquiry, the section leader in the planning-purchasing department makes arrangements whereby information relating to delivery is automatically given to the progress man.

The latter is in possession of information regarding the original delivery dates, and he assumes that these will be kept unless he hears to the contrary. The onus, then, is upon the section leader to forward him copies of all correspondence bearing upon deliveries, so that, should a supplier write to the effect that the date given will be exceeded, this information is accorded the progress man at the earliest possible moment. The progress man is thus able to take steps to combat the trouble, or can notify the planning-purchasing department if there is likely to be any untoward effect. In the latter case the section leader may endeavour to obtain relief

by placing a rush order elsewhere, or by personally visiting the supplier with a view to emphasising the extreme urgency of the matter.

When goods are advised as being dispatched, the advice note is sent to the receiving store, *via* the progress office, as the information contained therein may be of value to the progress man; for the goods in question may be urgently wanted, and the progress man will await their arrival and see that no time is lost in unpacking and inspecting.

The "daily list of goods received," compiled by the receiving clerk, is used by the section leader for completing his records, and in the absence of an inspector's report, adversely commenting upon the consignment received, it is assumed that the parts in question are quite satisfactory. A copy of this list goes to the progress man, and the attentions of this individual ensure that inspection is handled expeditiously, so that the result may be known to the section leader without undue delay.

BUSINESS NOTES.

Bankruptcy Proceedings.—Ernest Walter Adams, 664, Old Kent Road, S.E., lately trading as the "Wireless Accessories Stores."—The debtor recently presented his petition at the London Bankruptcy Court, and on August 9th the first meeting of creditors was held before Mr. Ernest Parke, Official Receiver. It transpired that the debtor started the above business in July, 1922, in partnership with his brother. He purchased wireless outfits and equipment from various wholesale houses and trouble had arisen over some equipment which he bought from the North London Wireless Co., and which was unstamped, with the result that it was returned by the purchasers, who were unable to obtain licences. Acting under advice the debtor returned the goods to the North London Wireless Co., which brought an action to compel him to stand by his order and take delivery of the sets, and eventually obtained judgment against him with costs. In default of payment the company obtained a committal order, whereupon the debtor filed his petition. In April last the debtor converted his business into a company registered as "Wireless Accessories, Ltd." The company took over the stock but not the liabilities, and the debtor received as consideration a bill at six months for £218, which was now charged to a pawnbroker for £50. He estimated his liabilities at £200 and valued his assets at £3 6s. The failure was attributed to the purchase of unstamped wireless sets, cost of litigation, lack of capital, and to the recent slump in the wireless trade owing to trouble in procuring licences. The case remained in the hands of the Official Receiver to be wound up in bankruptcy.

W. H. Borrows, engineer and electrican, Werrington, Northampton.—Trustee, Mr. J. D. Morris, Official Receiver, 5, Petty Cury, Cambridge, released July 31st.

G. R. Topliss, electrical engineer, 9, Palatine Chambers, Halifax.—Receiving order made August 11th on debtor's own petition.

J. Michael, electrical engineer, 6, Sneyd Terrace, Silverdale, and 20, George Street, Newcastle-under-Lyme.—First meeting, August 23rd, at the Official Receiver's Office, 9, Brook Street, Stoke-upon-Trent; public examination, August 30th, at the Town Hall, Stoke-upon-Trent.

Company Liquidations.—Calphos Electrical Co., Ltd., electric lamp manufacturers, 70, Victoria Street, London.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on August 10th at Gow's Restaurant, 357, Strand, London, W.C., when the chair was occupied by Mr. Dejong. The liquidator in the voluntary liquidation of the company, Mr. C. T. Payne, corporate accountant, 80, Lancaster Road, West Norwood, S.E., submitted a statement of affairs which showed liabilities £3,549, made up as follows:—Trade creditors, £1,687; expense creditors, £640; bank overdraft, £201; and directors and others for loans, £1,011. The assets consisted of stock-in-trade £782, expected to produce £220; fixtures, fittings, and utensils, estimated to realise £30; and book debts £683, expected to produce £516; making total assets £766; from which had to be deducted £345 for preferential claims; leaving net assets £421; or an estimated deficiency as regards creditors, subject to the costs of liquidation, of £3,127. The liquidator stated that one or two small creditors had obtained judgment against the company, and the bailiff was in possession of the stock-in-trade and the fittings, &c. It was reported that the company was formed in May, 1922, with a capital of £100, by Mr. Peterson and Mr. Culey. Mr. Peterson provided the £100 and went over to the Continent and fixed up a contract for the supply of Dutch lamps. After paying for the expenses of the trip the company was left with about £40 working capital. Mr. Payne said that the company was started in a bad time of the year, but towards September, 1922, the sales began to go up and were about £300 to £400 a month. The directors found that £40 was not sufficient for them to carry on and they saw a Mr. Norton and a Mr. Thompson who put up £500 each and in return they were allotted shares. Mr. Payne added that a minute was passed at a directors' meeting in October last that Mr. Norton and Mr. Thompson should be appointed joint managers at a salary of £5 a week and an additional £3 for expenses. He went on to say that things began to boom and the sales then increased to about £800 a month. In January last they came across a patent flash adapter for which the owner wanted £750 to be paid down. The directors then approached Mr. Buckton, who put £1,000 into the company and in return was allotted 250 shares, and the company took up the flash adapter patents. One of the directors who was present at the meeting stated that the flash adapter business was a failure and that money had been lost over it. They had sold the patents to a very large firm who were interested. Mr. Payne said that a balance sheet had been prepared for a period from May 14th to March 31st, which showed that a gross profit of £872 had been made. The expenses were £3,245, and other items of income were £126, premium on shares £850, and goodwill was put down at £600, with the result that there was a net loss shown of just over £800. A creditor asked what the stock chiefly consisted of and Mr. Payne replied that it was mostly lamps and shades and a number of flashers. A creditor expressed dissatisfaction with the position disclosed and proposed that the company be wound up in compulsory liquidation. An amendment was then proposed that the liquidation should be left in the hands of Mr. Payne, and on being put to the vote it was decided that Mr. Payne should remain as liquidator of the company. The following are creditors:—

	£		£
Dejong, —	307	Chedel & Welthow	15
Visible Writing Machine Co. ...	15	Crissenden & Young	126
Tench, H. J.	37	Shanks, Ltd.	30
Stella Lamp Co.	50	Eclair Lamp Works	14
Partner & Peerman	71	Defiance Electric Co.	63
Smith, C. H.	23	Adair, P.	104
Kenlake & Jefson	10	Tapp Jarvis Publicity Service ...	315
Minchost	18	New Magnet Co.	18
Phillips' Glow Lamp Co. ...	15	Gooch, —	27
Robin, Adair	26	Smith, J. & W. B., Ltd.	14
Graphic Art Press	23	Rogers' Electric Sales	36
Brightling & Co., Ltd.	26		

The Swift Electrical Co., Ltd., electrical accessory manufacturers, 6, Cork Street, Old Bond Street, W.1.—Under the compulsory liquidation of this company accounts have been lodged showing liabilities £1,959, against assets £280. A report of the statutory meetings of the creditors and shareholders recently appeared in these columns. The following are the principal creditors (unsecured):—

	£		£
Best & Lloyd, Ltd.	170	National Electric Supplies Co.	16
Bullers, Ltd.	14	New Italian Art Association ...	51
Edison Swan Electric Co., Ltd.	15	Osborn, H. G.	17
Electrical Review	15	Perfecta Seamless Steel Tube and Conduit Co., Ltd. ...	20
Electric Ordnance and Accessories Co., Ltd.	141	Robins, R. W., & Co.	19
Emanuel, A., & Sons, Ltd. ...	12	Saxonia Electric Wire Co. ...	119
Etchells, T.	35	Siemens Bros. & Co., Ltd. ...	48
Goodinge & Sons	17	Sloog, H.	339
Hall Bros., Ltd.	29	Smith, H. W., & Co., Ltd. ...	25
Hawkins Bros. & Co., Ltd. ...	17	Thomas, F., & Co.	24
Head's Electrical, Ltd. (in liq.)	11	Underwood (Manchester), Ltd. ...	51
Leigh, H. E.	107	Vulcan Electric and Mechanical Co., Ltd.	23
London Commercial Electric Stores	55	Waltho, P., & Bros.	93
Lundberg, A. P., & Sons ...	90	Watshams	114
Magic Appliances, Ltd.	33	Welco Patents	27
Metropolitan-Vickers Electrical Co., Ltd.	18	Preferential creditors	126

Lowth & Smith, Ltd., electrical engineers, &c., 3, Hanging Ditch, Manchester.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on August 2nd at the Building Trades Association offices, 10, South Parade, St. Mary's Parsonage, Manchester. No statement of affairs was presented but a statement was read disclosing liabilities £3,599, of which £3,120 was due to unsecured creditors, while the bank was claiming for £479. It was stated that the bank held collateral security in the shape of debentures for £515, with a floating charge on all the property of the company. The assets consisted of office furniture valued at £50, deposits £27, motor wagons £20, stock £900 (expected to produce £300), and debtors £1,400 (expected to produce £600), making total assets £997, from which had to be deducted £35 for preferential claims and £515 for debentures, leaving net assets £447, or a deficiency as regarded the creditors subject to the costs of liquidation of £3,152. It was reported that the turnover for the last twelve months had been in the neighbourhood of £4,900, while the expenses had been £6,560, and there had been a trading loss of approximately £1,532. Up to July last year the directors were Messrs. Lowth & Smith, but in November last a Mr. Thompson was introduced and put in

capital to the extent of £1,000. The salaries paid to the directors for the last twelve months had been £766 and there was a sum of £200 owing to each of them. After the matter had been fully discussed it was decided to confirm the voluntary liquidation of the company, with Mr. McGregor as liquidator, with a committee of inspection of some of the principal creditors. The following are creditors:—

	£		£
Ashworth & Smith, Ltd. ...	115	Hindle & Co., Ltd.	97
Baxendale & Co., Ltd.	48	Johnson & Phillips, Ltd.	20
Birmingham Products, Ltd. ...	32	Liverpool Electric Cable Co. ...	120
Brown, S. G.	47	Metropolitan-Vickers Electrical Co., Ltd.	72
Callender's Cable Co., Ltd. ...	59	Royal Accumulator Co.	83
Clark, H., & Co., Ltd.	37	Sloan Electrical Co.	86
Crowther & Osborne, Ltd. ...	37	Telephone Manufacturing Co., Ltd.	100
Electrical Supplies Co., Ltd. ...	36	Telegraph Co., Ltd.	36
Electrical Co., Ltd.	133	Underwood Co., Ltd.	39
General Electric Co., Ltd. ...	130	Ward & Goldstone, Ltd.	36
Greengate & Irwell Rubber Co.	44	Edison Swan Electric Co., Ltd.	38
Hall Bros.	70		
Henley's Telegraph Works Co., Ltd.	72		

Ironclad Switchgear Co., Ltd., Eccles Hill, Monton Lane, Eccles.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on August 10th at the Chartered Accountants' Hall, Manchester, when the liquidator in the voluntary liquidation of the company, Mr. W. P. Masterton, stated that the liabilities were as follows: Secured creditors £272, preferential claims £635, unsecured creditors £4,138, and the Manchester and County Bank, Ltd,, £7,147, but the liquidator stated that the bank held security to the extent of £6,000. The assets were as follows: Plant and machinery, £1,345; fixtures and fittings, £300; office furniture, £107; jigs, £1,382; patterns and pattern tools, £1,500; good book debts, £652; doubtful debts, £88; and bad debts, £2,024. It was stated that the stock of the company as at February, 1923, was put down at £10,865. The liquidator added that on the figures submitted there would be a surplus to unsecured creditors of £3,849, but there were further claims to come in, which he thought would amount to about £1,000 at least. The books of the company had been kept very badly since February, 1922. He was of the opinion that there had been lack of supervision in the works. The books had been entered very carelessly, and invoices had been missed out. In a large number of instances firms were included as debtors to the company whereas he had had reports that their claims had been settled. The stock had been very much overvalued, as also were the patterns, &c. The liquidator stated that before a proper statement of affairs could be prepared it would be necessary to make a full investigation of the whole of the company's books. The majority of the patterns were in the hands of creditors. The liquidator stated that the company was formed in February, 1919, with a capital of £4,000 divided into 4,000 £1 shares. The capital was increased to £12,000 in May, 1920. He added that at the present time 7,300 £1 shares were allotted and paid up. The present directors were E. W. Morgan and S. Whittaker. Mr. B. S. Blackwool resigned in June of last year. For the year to February, 1920, there was made a loss of £1,072. In 1921 there was a profit of £1,902, and in 1922 a further profit of £456, while for 1923 there was a loss of £970. The sales for the twelve months ended February, 1920, were £1,405; 1921, £12,696; 1922, £9,217; and 1923, £15,318. Dissatisfaction was expressed at the position disclosed, and eventually a resolution was passed in favour of the voluntary liquidation of the company being continued, with Mr. Masterton as liquidator. A committee was also appointed. The following are creditors:—

	£		£
Birmingham Products	50	Matthews, J. W.	22
Bazeley, G. E.	24	Hartley, Widle & Charlton ...	55
Burton Delingpole & Co., Ltd.	10	Neal, W. V.	52
British Thomson-Houston Co., Ltd.	82	Percival Spencer, Ltd.	12
Churchill, C.	95	Mander Bros.	19
Greengate & Irwell Rubber Co., Ltd.	41	Record Polish Co.	22
Limerick, S. G., & Co.	28	Robert, Edwards	79
Mining Electrical Engineer ...	100	Star Foundry Co., Ltd.	155
Ogden, Ogles & Co.	22	Eccles Taxi-Cab Co.	17
Pratt, F.	49	Heaton & Dugard, Ltd.	51
Sydenham & McOustra	53	ELECTRICAL REVIEW	67
Castle Eng. Co.	11	Kelly, R., & Sons, Ltd.	35
The Electrician	22	Wade, C., & Sons, Ltd.	137
Electrical Consulting and Supply Co.	45	Woodrow, J., & Sons	13
Fyfe, Ltd.	63	Kearsley, Robert, & Co., Ltd.	18
Sloan Electrical Co., Ltd. ...	16	Siddons, J. & J., Ltd.	38
Vowles Bros.	41	Ellis, David	16
Warrington Light Casting Co.	18	Hampton & Dean	22
Whiffer, E., & Co.	35	*Electrical Times*, Ltd.	150
Morgan, E. W.	109	Dvardon, Brevis & Co.	165
Whittaker, S.	111	Abis & Co. (Birmingham), Ltd.	176
Catchpole & Maurice	147	City Pattern Co.	18
George, G.	16	Attwater & Sons	64
Kent, W.	220	Beaver, W. & J.	30
London & N.W. Railway ...	107	United Brass Foundry and Engineering Co., Ltd.	43
Metropolitan-Vickers Electrical Co., Ltd.	96	Ashford, Dunn & Co.	25
Manner Foundry Co., Ltd. ...	156	Switchgear & Cowans, Ltd. ...	22
Webster, F. J.	30	Siluminite Insulator Co., Ltd. ...	22
Smith, F. & Co., Ltd.	66	Morley Bros.	34
Sutcliffe, Hy.	126	Baxendale & Co., Ltd.	19
Tanner Bros. Asbestos Co. ...	21	McGeoch, Wm., & Co., Ltd. ...	21
Dynham, J.	43	Singer, J. W., & Sons, Ltd. ...	15
		Marshall & Wilkinson	121

Nuneaton Electrical Contracting Co., Ltd.—Particulars of claims to the joint liquidators, Mr. P. Russell, Newdegate Street, Nuneaton, or Mr. A. Cripwell, 12, Cherry Street, Birmingham, by August 31st.

Electro-Chemical Manufacturing Co., Ltd., wireless manufacturers and agents, Eyre Street Hill, Clerkenwell, London.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on August 14th at the Dean Hotel, Oxford Street, W., when the chair was occupied by the liquidator of the company, Mr. G. E. McCanlis. It was stated that the liabilities amounted to £628, all due to unsecured creditors. The assets consisted of stock £97, cash at bank 7s. 4d., share in the British Broadcasting Co. £1, and book debts estimated to produce £30, making total assets £129, from which had to be deducted £98 for preferential claims, leaving net assets £31, or a deficiency, subject to the costs of liquidation, of £597. Mr. McCanlis reported that he had prepared a deficiency account which showed that there had been a net loss of £509 on the carrying on of the business since February 6th last. In addition substantial amounts had been written off the assets in respect of depreciation and bad debts. The liquidator added that the landlord had distrained for rent due and had taken possession of the stock, &c., and it had been sold, and he (the liquidator) had been handed a small balance. It would appear that the company was only formed on February 6th last with a nominal capital of £400, divided into 400 shares of the face value of £1 each. The company took over an existing business to establish and carry on as wireless engineers and manufacturers, &c. The company paid £300 for the stock, plant, and goodwill, satisfied by the allotment of 300 shares of £1 each. It was stated that £100 was subscribed in cash. The directors of the company were Mr. M. Warriner, Mr. A. E. Katz, Mr. W. H. Hitchcock, and Mr. R. Reinheimer. The liquidator went on to say that no books or records of the trading had been kept, and it was therefore impossible to give the meeting any trading figures. He had no records of the purchases or the sales. After discussion the meeting broke up without any resolutions being passed; the matter therefore remains in the hands of Mr. McCanlis as liquidator. The following are creditors:—

	£		£
Besto, Ltd.	16	Harrell, Ltd.	20
Cook, L. V.	11	Paragon Rubber Mfg. Co., Ltd.	20
Crystalate Mfg. Co., Ltd. ...	38	Warriner, M. M.	450
Freed, J. W.	16		

Newington Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. D. Bell, 14, Dale Street, Liverpool.

Ventiheta, Ltd.—Liquidator, Mr. A. A. Lowe, 12, Coleman Street, E.C., appointed July 24th.

James Scott, Ltd., electrical engineers, Knowsley Road, Bootle.—The creditors interested herein were called together on August 14th at the Law Association Rooms, Liverpool, when a statement of affairs was presented which showed ranking liabilities of £25,871. It was pointed out that there were 590 trade creditors, whose claims aggregated £15,997, and partly secured creditors for £24,278. The latter held securities valued at £14,403, thus leaving £9,874 to rank as unsecured. There were also fully secured creditors for £600. The assets consisted of: cash in hand, £155; stock, £5,000; machinery, fittings, &c., £1,620; work in progress, £2,250; shares, £5; motor cars, £500; and book debts, £10,600, estimated to realise £9,150; making total assets of £18,680, from which had to be deducted £1,135 for preferential claims, leaving net assets of £17,545, or a deficiency as regarded the creditors of £8,327. It was reported that the company was registered in October, 1908, with a nominal capital of £5,000. It appeared that ordinary shares to the value of £1,600 were allotted as fully paid, while shares for £620 were issued for cash. In 1911 the company found itself in some difficulties, but these were surmounted, and it was able to carry on successfully. During the war the business expanded to such an extent that it became necessary to increase the capital, which was done, it being brought up to £30,000, divided into 25,000 preference shares and 5,000 ordinary shares of the face value of £1 each. In April, 1919, additional shares were issued for cash, and in the following year it was decided to take over another business, which was to be purchased for £2,000 in cash and £21,500 in shares. The amalgamation, however, could not be carried through. After discussing the position, a resolution was passed confirming the voluntary liquidation of the company, with Mr. W. R. Macgregor as liquidator, and it was decided that an application should be made to the Court for the appointment of a committee, consisting of Mr. Parkin S. Booth and representatives of Electric Supplies (Liverpool), Ltd., W. T. Henley's Telegraph Works Co., Ltd., Edison Swan Electric, Ltd., the General Electric Co., Ltd., and the bank. The principal creditors are:—

	£		£
British Insulated and Helsby Cables, Ltd.	115	Hewitt & Kellett	363
Boothroyd, H. T., Ltd.	156	Johnson & Phillips, Ltd. ...	298
Bennis, Edward, & Co., Ltd. ...	130	Liverpool Corporation	377
Boulton & Paul, Ltd.	118	Leach, S. G., & Co., Ltd. ...	141
Baxendale & Co., Ltd.	126	Lancashire Dynamo & Motor Co.	376
Concordia Electric Wire Co. ...	241	London Electric Wire Co. and Smiths, Ltd.	114
Cable Accessories Co., Ltd ...	136	Lea Recorder, Ltd.	121
Callender's Cable and Construction Co., Ltd.	123	Morley, T. B., & Co., Ltd. ...	196
Clarke, W., & Co. (Manchester), Ltd.	147	Metropolitan-Vickers Electrical Co., Ltd.	437
Electric Supplies (Liverpool), Ltd.	3,125	Manlove, Alliott & Co., Ltd. ...	299
Edison Swan Electric, Ltd. ...	479	Parr, Jos., & Co., Ltd.	136
General Electric Co., Ltd. ...	306	Peach, A. W., & Co., Ltd. ...	161
Graham, A., & Co., Ltd. ...	144	Ross & Alexander	334
Henley's, W. T., Telegraph Works Co., Ltd.	521	Siemens Bros., Ltd.	140
		Sawyer, T., & Co., Ltd. ...	302
		Wilton's Engineering Co., Ltd.	111

Dissolution of Partnership.—Victoria Electric Plant Co., electric motor and dynamo engineers, Spenser Street, Victoria Street, S.W.—Mr. H. Bloodworth and Mr. N. E. Brevig have dissolved partnership. Mr. Brevig will attend to debts and continue the business under the same style.

Catalogues and Lists.—Messrs. Ibbetson & Co., 57-58, Chancery Lane, W.C.2.—Two illustrated pamphlets dealing with electric drills, grinders, &c. Priced.

Messrs. Yarrow & Co., Ltd., Scotstoun, Glasgow.—A well-illustrated brochure describing the principles and manufacture of "Yarrow" boilers.

La Metallurgique Electrique, 14, Rue Taitbout, Paris.—Three illustrated pamphlets (in French) dealing with lightning arresters, instrument transformers, power transformers, insulators, switches, &c.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—August list of motors and dynamos in stock.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Catalogue No. 7, illustrating and describing oil-immersed control gear for a.c. motors.

The B.A. Manufacturing Co., Derwent Wharf, 84, Glengall Road, Peckham, S.E.15.—A price list of brass screws, terminals, and small turned parts.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—Radio List No. 102, containing illustrations and prices of radio receiving sets, components, and accessories.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 278, a list of rotary-converter installations carried out by the firm; and Price List 2,111, giving illustrated particulars of ironclad oil-break switch pillars.

The Electrical Insulating Composition Co., Ltd., St. Mary's Buildings, 31, Quay Street, Manchester.—A pamphlet describing "Provol" insulating material, with details of tests carried out upon it at Faraday House.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—A pamphlet containing prices and illustrations of semi-indirect (bowl) lighting fittings.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—An illustrated and priced pamphlet dealing with a number of electric fires and heaters.

Messrs. Moorwoods, Ltd., Harleston Iron Works, Sheffield.—Catalogue No. 90, containing illustrated details of electric heating and cooking appliances. Also a booklet illustrating electric fires. Priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet F. 3884, bearing prices and illustrations of lanterns for street lighting, railway yards, and other exterior purposes.

Trade Announcements.—We have received from Messrs. Cargills, Ltd., of Balfour House, E.C.2, a copy of their Export Circular setting forth the features of the Electrical Engineering and General Export Service Department to which Mr. E. P. Bennett was appointed recently, taking control of purchasing and development. The Cargill business was established for export trade 80 years ago, and has many other departments.

Mr. Jabez Smith, electrical engineer, of 1 and 2, Market Street, Faversham, and 28, High Street, Sittingbourne, has taken into partnership his son, Mr. William Ewart Smith, who has for the last 20 years managed the business at Sittingbourne. The business will be carried on under the name of Jabez Smith & Son.

The Power & Lighting Supplies Co., Ltd., Manchester, has opened a branch business at 11, Halliwell Street, Chorley.

The Placing of Contracts Abroad.—At the annual meeting of Messrs. William Beardmore & Co., Ltd., the chairman, Lord Invernairn of Strathnairn, referred to the depression in industry, stating that high taxation was one of the main causes of this. A large proportion of taxation was due to the payment of unemployment relief, and this in turn was due, to a great extent, to the placing of contracts abroad instead of in this country. The speaker considered that the sanctioning of loans should be contingent upon an undertaking upon the part of the borrowers to place their orders with British firms.

Electric Steel in Norway.—The Stavanger Electric Steel Works Co., of Stavanger, reports that the production of castings and tool steel in 1922 was restricted owing to the situation of the market, and although the turnover was greater than in the preceding year, it was insufficient to ensure remunerative working. At present, however, the prospect exists of carrying on a profitable export trade.

For Sale.—Birmingham Corporation Electricity Department invites offers for two 1,000-kW alternators and two Babcock & Wilcox land-type water-tube boilers. (See our advertisement pages to-day.)

Fire.—The Enterprise Manufacturing Co., Ltd., reports that the fire which occurred at its premises, Grape Street, Shaftesbury Avenue, London, W.C.2, on Saturday afternoon last did no serious damage and no delay in execution of orders will result.

Siemens-Schuckert Works Closed.—A *Reuter* dispatch, dated Berlin, August 11th, states that the Siemens-Schuckert Electrical Co. has dismissed all its workers, numbering several thousands, from its branch in the Siemenstadt suburb of Berlin owing to the "passive resistance" attitude adopted by the men.

Wages in the Tramway Industry.—In accordance with the existing agreement governing wages in the tramway industry, a further reduction of 1s. per week in the wages of adult employés and 6d. per week in the case of employés under 18 was made as from the first full pay period in the present month, owing to a fall in the cost-of-living index figure. This makes a total reduction since the signing of the agreement of 16s. per week for adults and 8s. for juniors.

Unemployment.—The Employment Exchange returns dated July 30th showed that the total number of wholly unemployed persons had risen from 1,184,900 to 1,195,600 during the week, although the total was still 290,278 lower than at January 1st. There was also a rise in the number of workers upon "short time," the figure being 66,900, as against 62,094 a week earlier. On January 1st this class of worker numbered 56,261. The returns dated August 6th show decreases of 3,700 in the number of persons totally unemployed, and 2,000 in the number of "short-time" workers.

Japanese Copper and the Electrical Industry.—An interesting article in the *Bulletin* of the Tokio Chamber of Commerce describes Japan's transition from the position of an exporter of copper to the extent of 88 per cent. of her production in 1908 to that of an exporter of only 8 per cent. of her production in 1920, although her output rose from 40,026 tons in the former year to 66,663 tons in 1920. In 1917 it was as much as 106,346 tons.

Japan was for a long time the second largest copper producer in the world, being surpassed only by the United States. The latter's output in 1920 was 567,186 tons, while that of Chile was 93,000 tons, thus exceeding Japan's production in that year. The war had a two-fold effect on her copper trade. It caused a boom in production and at the same time brought in large imports, owing to the expansion of electrical manufacture and other industries using copper. Whereas during the war (1914-1918) purchases abroad varied from 30 tons to 5,000 tons only in a year, in each of the years 1919 and 1920 they totalled over 22,000 tons. The consumption of metal by the Japanese electrical industry has increased annually since the Chino-Japanese and the Russo-Japanese wars, and was not permanently checked at the Armistice. Whilst, however, imports kept fairly steady, home production declined, but at the same time exports to China and India have continued in considerable volume.

It is pointed out that costs of production at the Japanese mines exceed those in America although the former have been reduced by 15 to 20 per cent. since the war. In order to bring the costs down further, labour-saving devices are advocated, because wages are still at a high level in Japan. The article in the *Bulletin* criticises the action of the mine-owners in inducing the Government to place a heavy import duty on copper which, it is stated, has put up the price and is hampering the electrical industry.

An Empire Fortune for the Public Good.—Without personal liberty to engage in enterprise and enjoy the benefits thereof, the incentive to business success for one's own and the public good would be lacking. In the year 1853 there left these shores for Australia a young man of 22, named Alfred Felton. He became a wholesale druggist and general merchant in Melbourne, and went on from success to success in this line and later in grazing interests. As he prospered, he gave away large sums unostentatiously to public and private charities. He remained a bachelor, and when he passed away in 1904 at the age of 73, he left the whole of his estate, close upon half a million pounds (less duties, &c.), to the State. The value of the estate is now nearly £600,000, and the income therefrom is devoted partly to charities and partly to the purchase of works of art for the public gallery of Victoria. An account of what has been done with the money—the works of art purchased from 1905 down to December, 1922—is told in a booklet of between 80 and 90 pages issued by the Felton Bequests Committee. The career of Felton is one of special interest in these days when we are looking for the development of the resources of the Empire. Australia calls for population, and in due course men will "make good" as they have done in the past. Fifty years' hard work was crowned with financial success, but first the leash had to be loosed so that the adventurous spirit might venture forth.

Local Exhibition.—Aylesbury.—The Town Council is arranging an electrical exhibition in connection with the starting-up of a new turbo-alternator set early next month. As the tariffs in force are reasonable there should be scope for manufacturers of domestic appliances.

Correction.—In the advertisement of the Small Power Dynamo and Motor Co., Ltd., which appeared on page 22 of the Advertisement Supplement of the Electrical Review for June 1st, the sole agents for London, South of England, and Export were stated thus: "The City Electrical Co. (G.E.C., Ltd.), 1, Emerald Street, London, W.C.1." It will

be noted that there is an error in the letters given in parentheses—G.E.C. should, of course, read C.E.C., the initial letters of the company's title. The error was entirely due to the printer (not the advertiser), and we regret that the slip should have given rise to confusion.

Payment by Results.—The following is a copy of a letter written to *The Times* last week by Sir George Sutton, Bart., chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd. The letter bears upon the articles contributed to our contemporary by Mr. Pybus, which are referred to in our leader columns to-day:—"There are some products upon which the labour expended can be satisfactorily paid by results, and some upon which it cannot. There are some where it may be wholly by results and some only partially, and experience has taught me that a combined payment by time and by results is a satisfactory method to employé and employer. There are in this business operations where payment by results cannot safely be given with safety to the quality of the completed product; it has been tried and failed. But there are many operations where the combined system may be safely used, and in the works of this company it is used in some operations with satisfaction to all concerned. The principle is being extended to other departments as statistics of output are accumulated and circumstances permit of its adoption. The time wage necessary for the standard of living of the ordinary worker is paid as agreed by the joint industrial council of the industry. The output being known under the time system, the workers are paid an additional amount for increased output, and a long period of work on this system has convinced them that, however large the output is, there is no deduction from the bonus rate, except when machinery and appliances are improved, when a modification is made to the satisfaction of both employer and employed."

British Empire Exhibition.—The plans of the Electrical Development Association for a combined display at the British Empire Exhibition on behalf of the electric supply industry are maturing rapidly. We learn that a large number of undertakings, both municipal and company, have now made provision to support this work. Recent additions to the list show widespread interest and a desire to be represented, even amongst the smaller enterprises, who agree to bear their full share according to the scales agreed upon. The management of the enterprise will be primarily a matter for the supporters, the suppliers of electricity, and the example already set is proving most useful in deciding others and enabling the E.D.A. to secure the help needed to produce a valuable business-getting display.

An Electrical Installation at a Bakery.—Messrs. Barrow and Co., of Bury, recently carried out under the directions of Mr. J. B. Thornley, architect, a large electrical installation at the new bakery of The Bury and District Co-operative Society, Ltd.

Book Notices.—"Back to Prosperity," by Henry and Margaret Lowenfeld. Pp. 268+xii. London: Effingham Wilson. Price 5s. net.—This is an unorthodox work which puts forward a scheme for co-ordinating the amount of currency in circulation with the quantity of existing goods. It proposes the formation of a body which shall regulate this by a kind of "bill of exchange" method.

"The *Journal* of the Institute of Transport, July, 1923." London: The Institute. Price 10s. 6d.—The bulk of this issue of the *Journal* is devoted to the proceedings at the recent Sheffield Congress. The papers read at this function are reproduced *in extenso*, together with the discussions which followed their reading.

"Aluminium Facts and Figures" (Vest Pocket Edition). Pp. 56. London: The British Aluminium Co., Ltd. Price 2s. 6d.

"Engineers' Pocket Technical Dictionary, French-English," by M. Lvoff. Pp. 160. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.

"Practical Control of Electrical Energy," by A. G. Collis. Pp. xii+160; figs. 142. London: H. Frowde and Hodder and Stoughton. Price 10s. 6d. net.

"Electric Wiring Tables," by W. P. Maycock. Fourth edition, entirely revised by F. C. Raphael. Pp. vii+95. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

Contract for Glasgow Firm.—Sir William Arrol & Co., Glasgow, have secured the contract from the Hollinger Consolidated Gold Mines, one of the world's largest gold-producers, for the contruction of a dam and power-house on the Abitibi River, Ontario, Canada.

This contract, which apparently does not include the electrical machinery or transmission line that will be necessary to complete the scheme, is understood to involve $1,000,000, or about £200,000. The total cost of the scheme is expected to be over $3,000,000. Sir William Arrol & Co. have an office in Ontario, having opened one there in connection with the Welland Canal contract.—*The Times.*

Cable Rates and Empire Development.—*Imperial Commerce and Affairs* for August contains an interesting and timely article on "Cheap Cable Rates as a factor in Empire Development," a subject of the first importance, as we have stated frequently, in connection with the approaching Imperial Economic Conference.

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 14th:—Copper (electrolytic) bars, £70 10s., 25s. decrease; do. do. sheets, no change; do. do. wire rods, £80 10s., 25s. decrease; do. do. h.c. wire, 10 1/16d., ¼d. decrease.

Messrs. James & Shakespeare report August 15th:—Copper bars (best selected), sheet and rod, £98, £2 decrease; English pig lead, £25 10s., 5s. increase.

Contract Conditions.—At a meeting of the F.B.I. Contracts Committee, held on August 1st, the following subjects were considered: (1) The question of the adoption in all Government contracts of a uniform Arbitration Clause conforming to the principles of the Arbitration Act, 1889; (2) the replies on the subject of "open" contracts; and (3) a point which had arisen with H.M. Office of Works in respect of guaranteeing the maintenance of material over a period.

On the first of these questions, says the Federation *Bulletin*, the progress of negotiations was reported. It was stated that the question had been the subject of discussion by the Contracts Co-ordinating Committee representing the three Service Departments, but that a further departmental discussion would be necessary before a reply could be given to the Federation's proposal. On the question of "open" contracts replies to the questionnaire were submitted from a large number of trade associations representing industries where repetition orders for supplies are usual. It was evident from the replies that these industries were largely affected by the question, and it was generally agreed that the matter was one which should receive attention from the Federation, since the condition complained of ties the contractor to a fixed price for supplies over a period, without definite quantities being specified, or allowance made for variation in contract price. A number of trade associations, it was reported, had promised their co-operation. The third question relates to a requirement of H.M. Office of Works that contractors on its list must guarantee the durability of their products for a given number of years. This condition particularly affected the paint and varnish industry and was felt to be most unfair, since the material itself would be applied by a separate contractor. It was decided that the question should be investigated with a view to making representations on the subject to the department concerned.

LIGHTING AND POWER NOTES.

Australia.—Victoria.—In a recent article dealing with the activities of the Victorian Electricity Commission, the Melbourne *Age* stated that it was hoped to commence the supply of power to a number of places near Melbourne from the Morwell (brown coal) station before the end of the present year. The Morwell township had been receiving power from the station for the past 12 months. The first of the large turbo-alternators at the Newport "B" power house had been completed, and was expected to be put into operation last month (July). Three of the five generators for the Morwell station had been delivered, and two of them had already been placed in position, and four of the boilers were in process of erection. The main transmission line from Morwell to Melbourne was well advanced and was expected to be completed before the end of the year.

It was intended to sell to the public any quantities of brown-coal briquettes which remained over and above the requirements of the station. To convert the 25-cycle energy supplied by the Newport "A" station to conform with that supplied by the "B" station, a frequency changer had been installed at Yarraville; this was one of the largest of its kind.

Barking.—Year's Working.—There was a net profit of £5,000 upon the electricity undertaking for the year ended March 31st last.

Batley.—Year's Working.—It is reported that a net profit of £3,758 resulted from the working of the electricity undertaking during the past year.

Boston.—Electricity Supply.—The National Electrical Construction Co., Ltd., has informed the Corporation that a supply of electricity will be available within a year. The main cables are already ordered, and a site is being secured for a generating station.

Burton-on-Trent.—Extensions.—At a recent meeting of the Town Council, the chairman of the Electricity Committee stated that the expenditure upon the 6,000-kW extension had amounted to £110,850, and that a further £4,804 was required to complete the scheme.

Bury.—Year's Working.—The report of the engineer and manager of the municipal electricity undertaking (Mr. J. G. Potts) for the year ended March 31st last records an increase of £88,446, and a working expenditure of £55,167, leaving a gross surplus of £33,279. In the preceding year the equivalent figures were: Revenue, £94,724; expenditure, £70,566; gross surplus, £24,158. The interest and other capital charges increased, but nevertheless the net profit rose from £1,430 to £4,255. Of this amount, £1,000 was allocated to the aid of rates and the balance was transferred to reserve.

A total of £67,552 was spent on capital account, the bulk of this (£61,230) being on account of plant, machinery, &c., for the Chamber Hall station, the capacity of which was increased by 6,000 kW. A further 10,000 kW is in process of installation. The sales of energy amounted to 19,823,173 kWh, as compared with 15,030,223 kWh in 1921-22, and the maximum load rose from 6,441 kW to 8,130 kW.

Explosion.—An explosion recently occurred in an inspection chamber through the ignition of an accumulation of gas by a short-circuit spark, and a woman was injured. Inspection of all such chambers has been made to prevent a recurrence of this accident.

Workhouse Lighting.—The Board of Guardians contemplates installing electricity at the Institution. The supply will be obtained from the Corporation.

Crediton.—Electricity Scheme.—The Urban Council has obtained particulars of an electric lighting scheme, the estimated cost of which is £8,250. These are to be placed before the ratepayers before any action is taken.

Handforth.—Electricity Canvass.—The Urban Council has decided to canvass the district with the object of ascertaining whether the demand for electricity is sufficient to warrant the Council's undertaking a scheme.

Hazelgrove and Bramhall.—Loan.—The Urban Council has applied to the Electricity Commissioners for sanction to a loan of £40,000 for carrying out an electric lighting scheme. Of the total, £32,000 is to be expended forthwith, and £8,000 is to be reserved for mains, &c., when required.

Heywood.—Closing of Station.—The Corporation has decided to close down its power station and to take a bulk supply from Bury.

Huddersfield.—Supply to Outer Districts.—As the result of the recent inquiry into conflicting applications by the Corporation and the Electrical Distribution of Yorkshire, Ltd., for permission to supply electricity in certain outlying districts, the Electricity Commissioners have decided to grant powers to the company for this purpose.

Irish Free State.—Water Power.—In a recent issue the *Irish Independent*, Dublin, said that while experts were considering large schemes like the building of a dam at Poulaphouca to use water power for the production of electricity on a large scale, it was worth while noting that for purposes of agriculture and rural industry the smaller rivers in the country might be looked into. Mr. Crowley, the chairman of the Water Resources Committee of the Board of Trade, recently called attention to the possibility of using these rivers for power on the farm and for lighting. In North Wales, within ten years, 234 water-power installations were set up for lighting farmhouses and supplying electric power. Societies of the co-operative type might be formed, as they were in Germany, for this purpose. In Germany the number of co-operative electricity societies was nearly 700 or more than the total number of public electricity undertakings in these islands. The subject would repay study by farmers' representatives.

London.—St. Marylebone.—When the scheme for improved street lighting at a cost of £16,070 (*vide* Electrical Review, August 3rd, p. 175) came before the Council at a recent meeting, the Finance Committee objected to the expenditure of such a large sum, and a motion to refer the matter back to committee was carried.

Distribution Box Explosion.—On August 11th, a distributing box in Victoria Street, on the system of the Westminster Electric Supply Corporation, Ltd., exploded, tearing up a considerable length of pavement. A fire which followed was quickly extinguished by means of sand.

Milton Regis (Kent).—Permission to Supply.—The Urban Council has decided, subject to an agreement being entered into, to allow Messrs. F. Littlewood & Sons to supply electricity by overhead wires to premises in High Street.

Morocco.—New Concessions Decree.—The Moroccan newspapers have published a Decree relating to concessions by the Sherifian Government for the construction and exploitation of lines and power stations for the production, conveyance, and distribution of electric power. Various companies having interests in Morocco have been entrusted with the realisation of this important scheme.—*Reuter* (Paris).

New Mill (Yorks.).—Supply Agreement Approved.—At a meeting of the District Council on August 8th, a recommended agreement with the Yorkshire Electric Power Co. for the supply of electricity in bulk to the New Mill district was approved.

Normanton (Yorks.).—Electricity Supply.—The Urban Council has applied for a loan of £6,600 for the erection of a sub-station and the provision of cables, &c., in connection with the reception of a bulk supply from the Yorkshire Power Co.

Northern Ireland.—The Bann Water-power Scheme.—At the monthly meeting of the Portadown Town Council, a deputation which had attended a conference in Belfast in connection with the North Ulster Electricity Supply Bill to ascertain the views of the promoters of the Bill as to how the proposed scheme would affect the navigation of the Bann and the flooded areas, submitted a lengthy report. It was stated that the project had a financial backing of £1,000,000, and that the dredging operations alone would cost £163,000. The promoters expressed their willingness to give all particulars and information to any body or person opposed to the measure and to submit their data to any experts or engineers for verification. The deputation was favourably impressed by the candour with which the promoters expressed their views and presented their arguments, but as the Council was not in a position at present to disprove the arguments or challenge the data, the deputation recommended that the attitude adopted by the Council should be maintained until further information and particulars had been procured and verified. The report was adopted. The clerk suggested that the Council should ask the Northern Government to provide engineering assistance in connection with this matter and a motion to this effect was moved and passed unanimously.

Proposed Electricity Supply.—At a recent meeting of the Holywood (Co. Down) Urban Council the report of Mr. W. Pleasance, consulting engineer, relative to the proposed scheme for lighting the township by electricity was submitted, and it was resolved that a copy be forwarded to Mr. J. Green, engineer of the scheme, for his views. The Town Clerk was instructed to communicate with the Belfast Corporation and ascertain if it would be prepared to supply electricity for the lighting of the town, and upon what terms.

Peterborough.—Year's Working.—A deficit of £1,477 was incurred by the electricity undertaking during the past year. This was slightly higher than the loss of the previous year.

Preston.—New Station.—The new Ribble power station is planned for a capacity of 25,000 kW in two 12,500-kW sets. Over 1,100 tons of steel has been required for the framework and only 10 tons of girders now require to be placed in position. The boiler foundations have been completed and the boilers, five in number, will be installed shortly. It is anticipated that the power station will attract important industries, and that large mills and works will be erected on the land which is available. There is no reason to doubt that the contract time of 42 weeks will be observed in finishing the scheme, and the station should therefore be running in April or May next. The scheme of distribution includes the establishment of two sub-stations on the Preston side of the river. By an arrangement with the English Electric Co., Ltd., contractors for the station and plant, the main sub-station will be in the Dick, Kerr works of the company in Strand Road, and will supply both h.p. and l.p. current to the works, and other works and mills in the district, as well as energy for domestic lighting and heating. This arrangement has obviated the necessity of the Corporation building a separate sub-station in Marsh Lane (at an estimated cost of £5,500) as well as the cost of maintaining a separate staff. The second sub-station will be erected at Ribbleton.

The scheme provides for double transmission cables between the new station and Blackburn power station. The total cost of the scheme is estimated at £409,150 for the station, and £74,826 for the transmission cables between Preston and Blackburn, the two sub-stations and their equipment, mains and services, meters, &c., a total of £484,336.

Price Reductions.—Reductions in the price of electricity have been made in the following towns:—

Cheltenham.—Lighting, 7d. per kWh.

Heywood.—New tariff of 1½d. per kWh for domestic heating and cooking charges to come into operation at the end of September.

Maidenhead.—Within the borough: Ordinary lighting, from 9d. to 8d. per kWh; basement lighting, 7d. to 5d.: higher rate of the maximum demand tariff, 1s. 1d. to 1s.; higher rate of the two-rate tariff, 9d. to 8d.; prepayment tariff, 10d. to 8d.; ordinary power, 3d. to 2½d.; ordinary power contracts, reduction of ½d. per kWh. Outside the borough: Ordinary lighting, 9½d. to 8d.; ordinary power, ½d. per kWh above the rates within the borough. Public lighting, a reduction of 10s. per lamp.

Lynn.—Lighting charges to be reduced by ½d. per kWh and power by 20 per cent., as from October 1st.

Salford.—Loan.—The Town Council has applied to the Electricity Commissioners for permission to borrow £76,973 for mains and services, sub-stations, equipment, &c.

Sandwich.—Electricity Supply.—The Town Council has agreed in principle to the application for an Order to supply electricity by Sir Charles Bright & Partners, provided that the undertakers complete their arrangements to obtain electricity from the power house at Stonar, and meet the Corporation's objections to certain clauses of the Draft Order.

Sleaford.—Price Order.—The Urban Council has been granted an Order fixing the maximum price for electricity at 10d. per kWh, and the following tariff has been adopted: —Power and heating, 5½d.; lighting, &c., at places of worship and kinemas, 8½d.; general lighting, 9d.

Loan.—The Council has applied for a loan for the provision and laying of a new set of auxiliary feeders, at an estimated cost of £2,090.

(*Continued on page 254.*)

THE YORK HYDRO-ELECTRIC UNDERTAKING.

Inauguration of Linton Lock Station.

A hydro-electric power station, built to supplement the generating capacity of the City of York electricity undertaking, was formally inaugurated on August 1st by H.R.H. Princess Mary, Viscountess Lascelles. Situated on the River Ouse at Linton Lock, about 10 miles above the City, it is claimed to be the largest station of its kind in England, and Viscount Lascelles congratulated those concerned on the achievement of having introduced for the first time in England an automatic weir shutter.

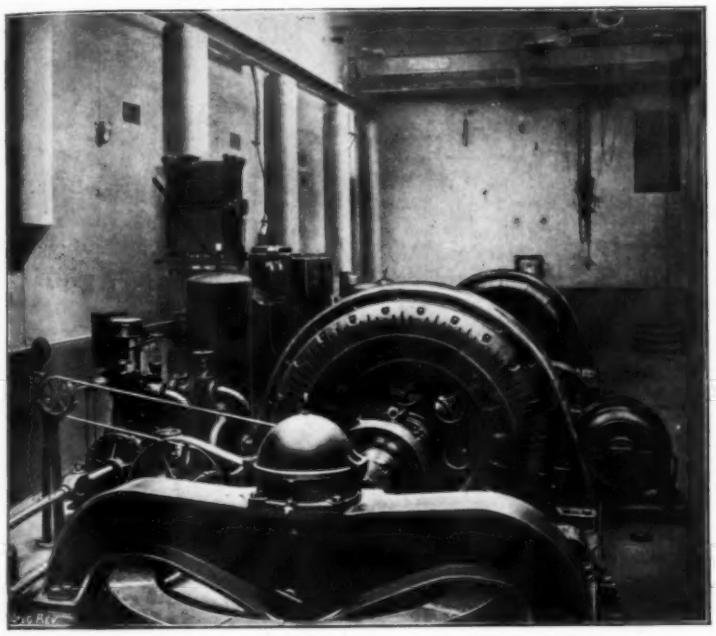

Fig. 1.—Interior of Power House.

The Ouse, like most rivers without natural compensation, has a very variable discharge; roughly speaking, it fluctuates between 5,000 cu. ft. per minute in the dry periods and 200,000 cu. ft. during the wet months. Therefore, taking 100,000 cu. ft. per minute as an average with a head of 8.83 ft., 1,200 h.p. could be expected from the proposed station, and calculation showed that the available energy in years of normal rainfall would exceed 2,750,000 kWh per annum. Under the circumstances, and considering the cost of coal, the scheme was considered a sound one, and the York Corporation decided, in order to concentrate supervision and responsibility and to make the co-ordination of the various parts of the work easier, to include the civil work, the buildings, and the supply of plant in one comprehensive contract, which was eventually awarded to the English Electric Co., Ltd.

The Linton Lock hydro-electric power station, as will be seen from fig. 8, is situated on an island, the nearest railway station being about 4½ miles distant; a carriage-way from the nearest main road, about half a mile away, had to be constructed, and the old lock at Linton had also to be bridged in order to get materials on to the island.

The site proved to be very soft silt below water level, and much difficulty was experienced in getting the foundations down below the river to the requisite depth; cofferdams, both of timber and steel, had to be constructed, and much pumping was necessary. The work was also handicapped by high floods, of which the one that occurred a few months ago was the highest experienced for 23 years. The power house, fig. 3, is carried on 111 ferro-concrete piles which go down about 60 ft. below the normal ground level, and is built of reinforced concrete. The foundations of the walls to the head and tail races involved some difficulty on account of the running silt; they were constructed of reinforced concrete. Owing to the danger of the water in the headrace finding its way below the building through the soft silt, it was necessary to take many precautionary measures to make sure that no such leakage could take place.

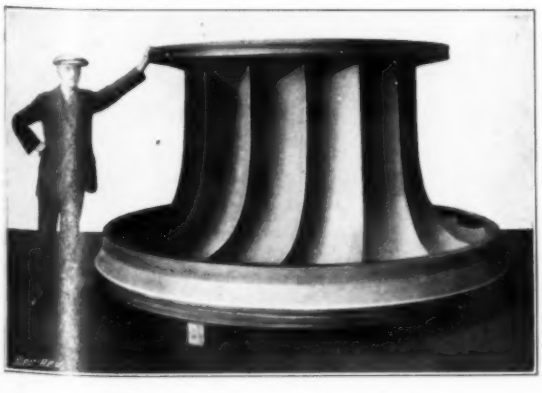

Fig. 2.—Runner for Large Turbine.

Fig. 3.—Exterior of Power House.

Considerable care had also to be exercised in connection with the foundations owing to the nearness of the lock cut to the works, as it was clear that if the river when in flood did break through the temporary works, it would wash out the silt very rapidly and do much damage along the river, both above and below the

F

site. The existing weir across the river was built about 100 years ago and, as no drawings were available to show the details of construction below the water level, it was necessary to proceed with much caution with the work in the neighbourhood of the old dam.

It can be seen from fig. 8 that the water is led to the forebay by means of this weir, but large automatic weir

FIG. 4.—MAIN SWITCHBOARD.

shutters have been constructed in order to keep the river at its correct level; these shutters fall in times of flood, thus enabling the flood water to pass, and as the river regains its normal flow, the shutters automatically rise and retain the water at its usual level. The automatic shutters themselves are controlled by counterweights made of pumice stone concrete of the correct specific gravity for the conditions under which they operate; the general design is shown in fig. 7. This arrangement does not interfere with the operation of the existing fish pass at the right bank of the weir, which can be seen in fig. 8.

The water entering the headrace, or forebay, on its way to the power house passes through strainer racks and the main sluice gates to three turbines: two large ones of 430 h.p. each, running at 60 r.p.m. and driving a 540-kW generator, and a smaller one of 330 h.p. running at 75 r.p.m. and driving a 210-kW generator. By using the three turbines in accordance with the accompanying working table it is possible to have the running plant always loaded up to more than 72 per cent. of its rated full load, apart from the lower limit in No. 3, or during a few exceptionally dry periods.

This means that the power station, on the average, will work with an hydraulic efficiency of from 75 to 83 per cent. according to the available heads, and will generate in years of normal rainfall about 2,780,000 kWh per annum.

The small turbine was specially designed to deal economically with the small loads; it has a specific speed so chosen as to give a high efficiency over a long range of partial loads and, therefore, will enable the power station to work efficiently even when only small quantities of water are flowing down the river.

TABLE I.

No.	Plant running.	Available output, h.p.	Per cent. of full load on turbines.
1	Small turbine ...	0— 330	0—100
2	One large turbine	330— 430	77—100
3	Small and one large turbines	430— 760	57—100
4	Two large turbines	760— 860	88—100
5	Three turbines ...	860—1,190	72—100

The water passes to the gate apparatus of the turbine inside the power house through concrete spirals, a

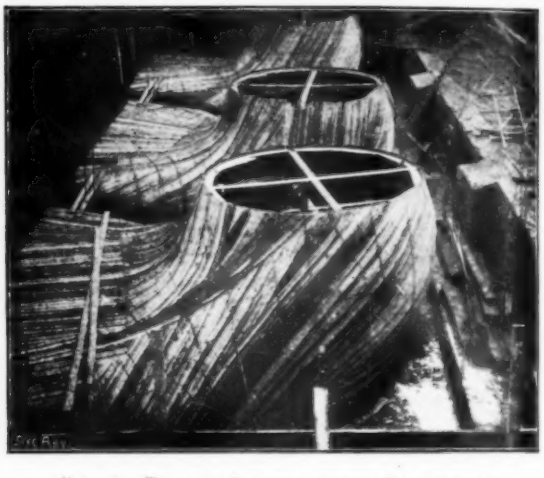

FIG. 5.—TURBINE OUTLETS UNDER CONSTRUCTION.

refinement which allows of a higher water velocity and effects a gain in efficiency as well as a saving of space, as compared with ordinary pits. Each gate apparatus consists of 20 guide vanes, 43.3 in. high for the large turbines and 35.5 in. high for the small turbine. The vanes are of cast-iron, pivoted at their ends in bronze bushes carried by the foundation rings, and are operated from above by means of levers and linkwork. The massive foundation rings of cast-iron are connected

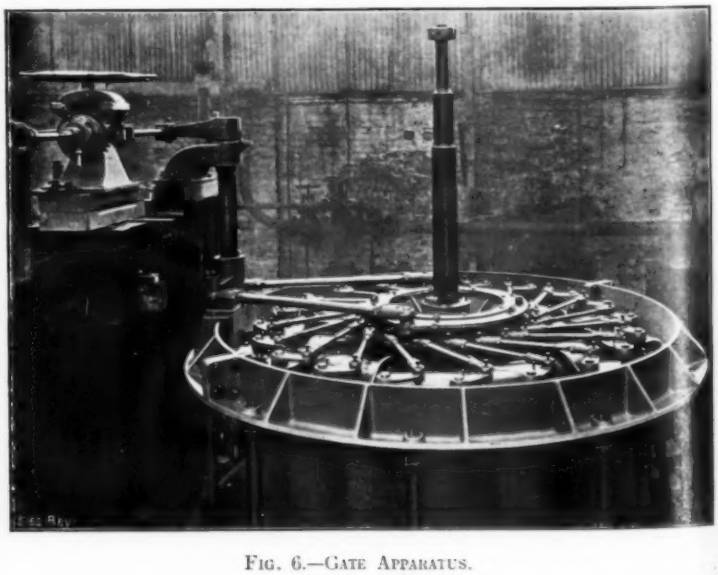

FIG. 6.—GATE APPARATUS.

by steel pillars and built into the concrete, thus forming a good and rigid assembly.

Fig. 6 shows the gate apparatus for one of the turbines in course of erection at the Willans Works, Rugby, of the English Electric Co. The weight of the runners is considerable owing to their dimensions; for the large turbine, which has an exit diameter of 10 ft., it amounts to over 5½ tons. From the vertical shafts of the turbines the drive is transmitted to the generators by means of machine-cut, double helical, bevel gears.

The speed of the sets is controlled by two automatic oil-pressure governors, and both head and tail races are connected to a water-level recorder in the power house which traces on a chart the head under which the turbines are working.

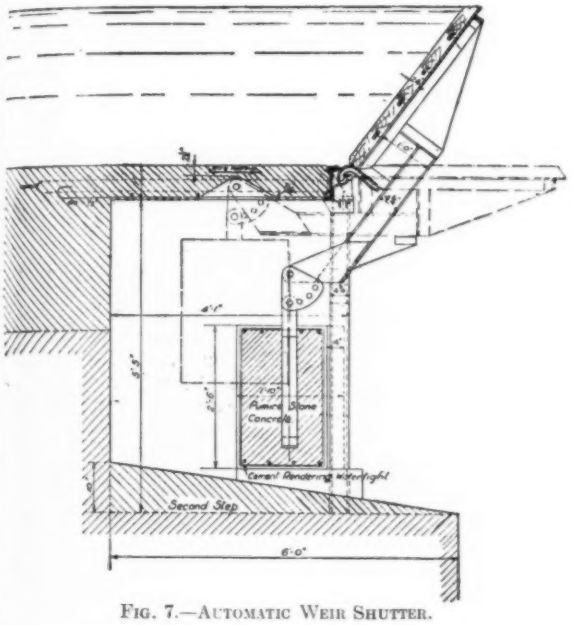

FIG. 7.—AUTOMATIC WEIR SHUTTER.

The generators, fig. 1, are alternating-current, 3-phase, 50-cycle machines, working at a terminal pressure of 6,600/7,000 volts. Both generators can withstand the runaway speed of the turbines, which is about 1.9 times their normal speed. The full-load efficiency of the generators is about 94 per cent., and taking 80 per cent. as the average efficiency for the turbines and allowing 2 per cent. loss in the bevel gears, the overall efficiency of the power station will be about 74 per cent.

The switchgear for controlling the two generators and one feeder, fig. 4, is of the "English Electric" cast-iron, draw-out pillar type, combining safety with compactness and ease of inspection. All live parts are completely enclosed, and fully interlocked in order to render them mistake-proof.

The electricity generated by this station will be transmitted to York by means of underground cables, from which a supply will also be given to villages, &c., along the route.

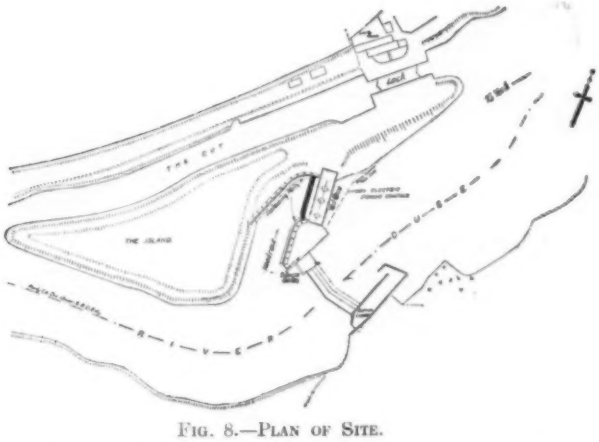

FIG. 8.—PLAN OF SITE.

We are indebted to Mr. E. J. Nichols, city electrical engineer, for permission to publish this article, and to him, as well as the English Electric Co., Ltd., for the loan of drawings and photographs from which the accompanying illustrations were reproduced.

WATER-POWER AT BARNALINE.

The Loch Awe, Argyllshire, Installation.

THE River Avich, from which the water is taken, is situated on the west side of Loch Awe in Argyllshire, and drains Loch Avich, at a height of 311 ft. above sea level, into Loch Awe at 116 ft. The river is about 1¼ miles long, in which distance it falls some 200 ft. Loch Avich is about three miles long by almost half a mile wide, and forms a large catchment area and natural reservoir. There is a rainfall of some 70 or 80 in. in the year.

FIG. 1.—INTAKE, LOOKING DOWN STREAM.

FIG. 2.—INTAKE AND VALVE.

After leaving the loch, the river falls very slowly for the first half mile, which is followed by a series of rapids or small falls, culminating in the main fall of 25 ft.; the map, fig. 4, which is drawn to scale, shows clearly the contours and nature of the ground met with in this portion of the stream.

The accompanying illustrations, figs. 1 and 2, show the weir and intake tank, the first looking down stream, and the return of the water into the river from the concrete lade, while the second, looking upstream, shows the completed intake arrangements with the impounded

water above. The main overflow will take all the water in the river, except in time of flood, when water will flow over the top of the wall across the full 30-ft. width of the stream.

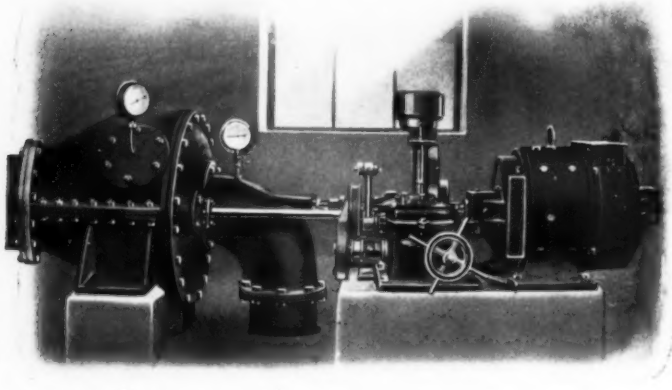

Fig. 3.—Turbine.

The first 900 ft. of the pipe line has a fall of only about 4 ft. 6 in. from the intake tank to the surge tank. In this distance two small ravines are crossed.

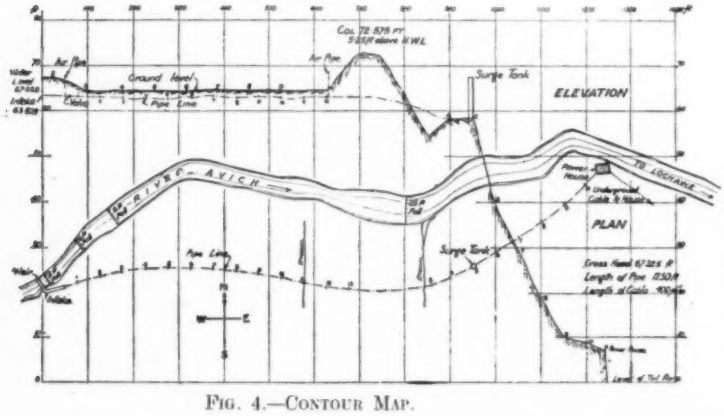

Fig. 4.—Contour Map.

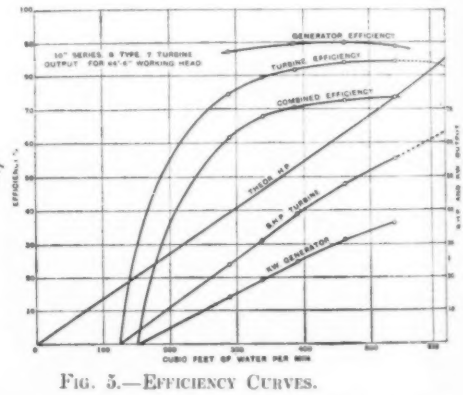

Fig. 5.—Efficiency Curves.

At the two lowest points drain cocks are provided, and at the entrance to the Col, where the pipe is slightly higher, an air pipe with a cock rises above the level of the intake water. The pipe line consists of about 1,200 ft. of single riveted mild steel pipes, 19 in. bore by $\frac{1}{8}$ in. thick; each pipe is made up of six sections and is about 25 ft. long. The whole is covered with Hessian, coated with Dr. Angus Smith's composition, and tested to 50 lb. per sq. in. The joints are made by means of Kimberley collars with lead and yarn and, although some large deviations from the straight were made, only two 150-degree bends were used. The pipes were made by Messrs. Mechans, Ltd.

The pipe line from the intake to the surge tank is laid underground and covered, except where it crosses the two streams mentioned above, where it is supported on and anchored by angle iron cross pieces tied into concrete foundations. From the surge tank to the power house it is partly covered and partly supported on concrete piers.

Owing to the long length of the pipe line, governing had to be very carefully considered. It was decided to erect a surge tank, 8 ft. by 4 ft., at the end of the long comparatively level pipe and to connect the tank to the lower 300 ft. of pipe to the power house, where the fall is steep, amounting to about 68 ft. The tank divides the pipe line into two separate, although interdependent, sections, so that the governor has to deal only with the water in the lower 300 ft. of pipe, while the surge tank deals with the water in the long section of more or less level pipe. This arrangement dispenses with the need of a relief valve. The top of the surge tank is at the same level as the top of the wall of the intake tank. In operation, the level of the water rises and falls with each change in load on the turbine, and Table I gives actual results obtained on site.

The total estimated head was 67.325 ft.; with a loss of 7 ft., the net head was approximately 60 ft. With 500 c.f./m. at 60 ft. net head, the turbine was designed to give 45 b.h.p. and 30 kW at 1,000 r.p.m. The level of the intake was raised a foot, and as the loss in head owing to absence of bends, &c., on the pipe line was rather less than that allowed, a net head of 62 ft., including 6 ft. of suction, was obtained. With the high efficiencies of the turbine and dynamo and at 500 c.f./m., the output obtained was 52 h.p. and 34 kW, or about 15 per cent. more than was expected.

The turbine was designed and manufactured by Messrs. Hay, Maryon Works (Stroud), Ltd., Stroud, Glos., the subsidiary manufacturing company of

Fig. 6.—Pipe Line and Power House.

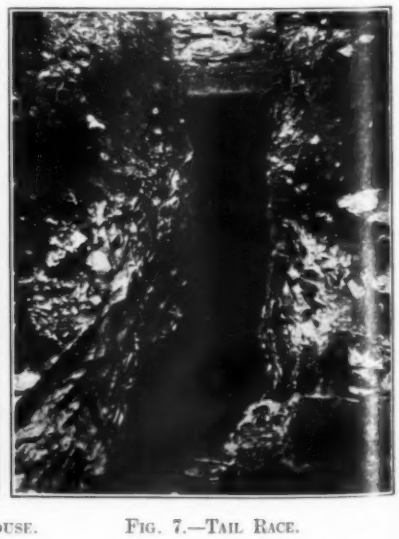

Fig. 7.—Tail Race.

Messrs. Hay, Maryon & Co., Ltd., London. Before despatch, the turbine was run under test in the test tank attached to the works, and an efficiency of 85 per cent. was obtained, calculated on actual b.h.p. as measured by brake, and the net head was taken to be the actual difference between the head-water level and the tail-water level without any deductions whatever.

TABLE I.

Amperes.		kW.	Water in c.f.m.	Level of water in tank.	Loss in head.
Turbine shut down...	...	—	—	7′ 8″	—
Turbine running					
no amps.	...	... 250 volts.	150	7′ 2″	0′ 6″
75	...	... 19.8 kW	350	6′ 0″	1′ 8″
86	...	... 23 kW	385	5′ 2″	2′ 6″
110	...	... 30 kW	460	3′ 2″	4′ 6″
125	...	... 34.5 kW	500	3′ 0″	4′ 8″

The turbine is direct coupled through a flywheel flexible coupling to a Horace Green & Co.'s compound-wound dynamo; fig. 3 shows the plant and the belt-driven governor, with pressure and suction gauges scaled in feet and lb. per sq. in.

The power house on the bank of the river is about 450 yards from the house to which it supplies electricity, and the drop on the line works out at about two volts per 10 amps. The dynamo was therefore designed to give 250 volts at no load at 1,000 r.p.m., and that pressure was obtained when the machine was hot with the shunt regulator about one third out. At a constant speed of 1,000, the voltage was 270 with 100 amps., and 278 with 130 amps., the shunt regulator remaining on the same stud. With the speed kept constant at 1,000 r.p.m. by the governor, the voltage in the house remains practically constant at 250 volts independently of the load. No batteries have, therefore, been fitted, as the plant runs continuously, and the simplicity of the installation with regard to switchboard connections, &c., can thus be realised.

The governor head of the usual type is driven by belt from a pulley on the shaft, and with small variations or gradual load changes of 5 or 10 amps., the voltage variation does not exceed 2 per cent. momentarily. With changes amounting to, say, 30 amps., the voltage will rise or fall to 260 or 240 momentarily, and within five seconds return again to the normal. With 90 amperes thrown off, the voltage in the power house rose from 265 to 290, swinging slowly back and forward over the normal, and in about half a minute had become steady at 250.

Under the difficult conditions obtaining, the sensitive oil-pressure governor, in conjunction with the flywheel and surge tank, operates in a very satisfactory and efficient way.

From the diagram of outputs, &c., fig. 5, taken from actual tests made on site in conjunction with water measurements and electrical output tests taken there and at the works, it will be seen that the efficiencies of both machines and of the combined plant are extremely high. Six readings were taken of the generator output, ranging from 10.8 to 35.7 kW, with corresponding speeds and guide-vane openings. From these, the b.h.p. output of the turbine has been calculated, using the generator efficiency curve, the amount of water used corresponding to each test being calculated from the actual guide-blade opening on the basis of the capacity of the turbine when in the test tank before delivery. Once a turbine has been calibrated in this manner, it forms a fairly reliable water meter. From these figures the turbine efficiency was calculated and plotted, and the combined efficiency obtained. Readings 2, 3, 4, 5, and 6 are shown on the chart in fig. 5, all of which lie on well-formed curves, proving that no serious errors have occurred either in the readings or subsequent calculations.

At 45 h.p. and 30 kW, the designed full output of the plant at 450 c.f./m., the combined efficiency is 72 per cent., while at 55 h.p. and 35.7 kW, or 20 per cent. overload, the efficiency is 73.5 per cent. This overload was obtained with 11/16 gate opening, and although the turbine would pass more water, which as a rule would be available, the dynamo could not be expected to give a higher output than this. A locking washer and nut were therefore fitted on the governor spindle, which prevent the gate opening further, and if more load than 130 amperes should be thrown on the dynamo, the speed and voltage would fall, so that the amperage on the machine would not increase. The rise of temperature in the dynamo after a 6-hours' run at 110 amps. was: Armature, 78 deg.; commutator, 67 deg.; fields, 41 deg. These figures were taken on test at the works, but as the cooling effect of the water in the power house is considerable, these temperatures would not be reached in practice.

The cable from the dynamo to the house is 0.1 sq. in. concentric p.i.l.c. and armoured, and is run direct in the ground. On the way, and at about half the distance to the house, it passes the kennels and gamekeeper's house. Owing to the difficulty of transport, this cable was brought on two drums, each weighing about 28 cwt., and a through junction box is fitted in the gamekeeper's house, from which a supply for the lighting there and for an overhead supply to another small house near by is taken. The lamps in these houses are all 260-volt ones, so that even at full load the lamps are not overrun. In the house the cable terminates in a main switchboard, with a voltmeter, ammeter, and circuit-breaker set to break at 135 amps. in the event of a "short." The apparatus supplied includes a Falco double-oven cooking range fitted with six hot-plates, and a grill and hot cupboard, with a total loading of 15.6 kW.

The hot-water system in the house is supplied from a 60-gallon copper tank fitted in the bathroom. This is heated by five elements wound on porcelain formers inserted in cross copper tubes, and as the air space between the elements and the copper tube, which is in direct contact with the water, is very small, the heating arrangements are very efficient. Each of the elements is loaded to 1,500 watts; three of them are controlled by a thermostat at any desired adjustable temperature, the other two being controlled by hand. As the elements are all connected to 10-ampere plugs, any arrangement to suit the conditions prevailing at the time may be adapted; for instance, the three lower elements may be connected to the "Grundy" thermostat, or if the automatic arrangement should not be required to be kept on during the night, one or two elements can be permanently left on, maintaining the temperature of the water as desired. A similar element heats the water in three tiers of 3-in. cast-iron pipes, which heat a drying-room that efficiently dries wet clothes. Throughout the house 2-kW or 3-kW Falco fires, kettles, irons, and vacuum cleaners, &c., are used. In the outbuildings a 10-h.p. motor drives a 27-in. circular saw used for cutting up timber from the estate for firewood should this be required. In the wash-house there is also fitted washing apparatus and a 12-gallon boiler for clothes washing.

Owing to the situation of the house, the transport of the material to the site was somewhat difficult.

With regard to the scheme from a financial point of view, taking into consideration the amount spent annually on the original system of lighting the house by a petrol engine, and the cost of coal delivered on site, none of which is now required, the saving shows a return on the capital invested of 6 per cent. or 7 per cent. This, of course, is quite apart from all the great conveniences and additional comfort obtained with the electrical installation.

The plant has run very satisfactorily since it was started up in the middle of January. The existing kitchen range has been left intact and connected up to the present hot water system through a two-way cock, so that in the event of a temporary failure of supply, the cooking and water heating can be done as before the installation was put in.

The whole scheme was designed by Mr. Arthur, and carried out under his personal supervision by Messrs. Allan Arthur and Ure, Glasgow.

LIGHTING AND POWER NOTES.

(*Continued from page 248.*)

Scotland.—Development of the Clyde.—A scheme for utilising the water of the upper reaches of the Clyde is proposed, the promoters representing the ground proprietors. Preliminary negotiations have been opened between the Clyde Valley Electrical Power Co. and the promoters with a view of giving a supply to the eastern portion of the company's area.

Special Orders.—Confirmed by the Minister of Transport.—The undermentioned Special Orders, made by the Electricity Commissioners, have been confirmed by the Minister of Transport:—Salford (Swinton and Pendlebury); Yeovil (Electric Light & Power Co.); Llandrindod Wells (Urban District Council); Brentwood & District (Electric Co., Ltd.); Lyme Regis (Town Council); Crompton (Urban District Council); Royton (Urban District Council); and Lees (Urban District Council). The last three Orders are to be taken over by the Oldham Corporation.

Stourbridge.—Workhouse Lighting.—The Board of Guardians has the question of the electric lighting of the Institution under consideration.

Uttoxeter.—Proposed Electricity Supply.—The Urban District Council is making inquiries with reference to a scheme of electricity supply to the town.

Wilmslow.—Inquiry.—The Ministry of Transport, after holding a local inquiry, has granted an Order to the electric light company fixing, for the next three years, the charge for electricity at 10d. per kWh, with minimum payments of 12s. 6d. for each winter quarter, and 8s. 4d. for each summer quarter. The company applied for authority to charge 1s. per kWh.

Winchester.—Year's Working.—The report of the city electrical engineer (Mr. R. Ayton) for the year ended March 31st last states that the total revenue of the undertaking was £31,273, as compared with £30,458 in the previous year. Working expenses totalled £20,671, as against £22,497, leaving a gross surplus of £10,602 (£7,961). Capital charges were about £800 higher than in the preceding year, and the net result was a profit of £2,893, as compared with £1,048 in 1921-22. There was an increase of 236,502 kWh, or 15.8 per cent., in the sales of energy. The report states that, owing to the absence of an industrial load, there is a considerable falling-off of consumption in the summer, and efforts have been made to counteract this by developing electric cooking. It is not desirable to seek a larger winter load until the station capacity is increased and the network strengthened.

Wrexham.—Objection to Scheme Withdrawn.—The Town Council has withdrawn its objection to the North Wales and South Cheshire electricity scheme, and has agreed to take a bulk supply of electricity from the North Wales Power Co. on agreed terms. The company is being asked not to exercise any rights it may have of supplying existing customers of the Corporation directly.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Railless Traction.—The Corporation's proposal to run railless trolley cars between Ashton and Hathershaw, in view of the heavy cost which the reconstruction of the track would entail, has formed the subject of discussion by representatives of the Ashton and Oldham Corporations. With a view to continuing the present through-running, Ashton Corporation was desirous of ascertaining whether Oldham Corporation was prepared to consider the provision of the necessary overhead equipment from Hathershaw boundary to the Star Inn, and to provide two 'buses. After receiving a report from its sub-committee, the Oldham Tramways Committee has generally approved of the principle of through-running and the provision of two 'buses, and decided that the necessary details be considered later.

Brighton.—Strike.—A "lightning" strike of tramway employés occurred on Sunday morning last owing to a grievance with regard to hours of working. The management agreed to take on more men to enable an eight-hour day to be worked, and after a stoppage of about two hours the men resumed work.

Dutch East Indies.—Railway Electrification.—According to *Eastern Engineering*, work will be commenced on the electrification of one important main line in the Dutch East Indies as soon as financial conditions are favourable. Electrification of other lines will depend upon the results achieved in the way of reduction of operating costs and increased returns as compared with the present system.

Glasgow.—Proposed Fare Reduction.—A reversion to ½d. fares on the tramways is recommended by the Tramways Committee.

Proposed New Plant.—Reporting on the requirements at Pinkston power station, in view of the tramway extensions at present under construction, the Corporation tramway manager has recommended that the two old 2,500-kW sets, which are at present being taken out, be replaced by one 10,000-kW set. The Tramway Committee has approved the report, and recommends that the Town Clerk be authorised to advertise for offers for the new 10,000-kW set.

New Route.—The extension of the tramways from Dumbreck to the Mosspark municipal housing scheme was opened recently.

London.—New Cars.—The six "Underground" cars which were designed for the rolling stock competition a few months ago are to be brought into service on the Hampstead line. Two hundred cars of similar types are being constructed, and will be put into service between Edgware and Moorgate when the through-running commences early next year.

Underground Railway Improvements.—Work is now proceeding upon the reconstruction of the Westminster station. A new booking hall has been constructed and equipped with a battery of "Passimeters," increasing its working capacity by 50 per cent.

The Piccadilly Circus station is also to be improved considerably. This has been necessitated by the enormous growth of traffic. In 1907, the first complete year of operation, the number of passengers dealt with was 1½ millions; in 1922 this had reached the figure of 18 millions. Escalators are to take the places of the present lifts, and new ones are to be installed, making six escalators in all. A broad subway under the Circus completely encircling the booking hall will be a feature of the new station. Seven entrances are to be provided at various points around the Circus. The "Passimeter" system which is being installed will practically abolish booking-office queues. The improvement of Regent Street will increase the traffic to a great extent, and the "Underground" companies are therefore providing for this by the reconstruction of the Oxford Circus station as well.

Lytham-St. Annes.—Loans Sanctioned.—The Ministry of Transport has sanctioned the borrowing of £17,135 for the purchase of 10 new covered-top tramcars, £4,380 for motor-omnibuses and a petrol store, £8,111 for the extension of the tramcar depôt, and £530 for a tramway shelter at Ansdell.

Nelson.—Loan.—The Tramway Department is making application to the Ministry of Transport for sanction to borrow £50,459 for the purpose of relaying the light railway track.

South Africa.—Railway Electrification.—According to the *South African Railways and Harbours Magazine*, the position as regarded the electrification of the Natal main line on June 1st was as follows:—For the Colenso power house, 24,000 cu. yd. of excavation had been carried out, and 16,300 cu. yd. of concrete placed in position. The cooling pond weir in the Tugela River was under construction. All the boiler house stanchions had been erected, and about half the basement floor completed. The erection of permanent quarters for the staff was nearing completion, and a commencement had been made with the construction of a native compound. A contract had been let to Messrs. E. C. & J. Keay, of Great Britain, for the provision of the steel framework for 12 sub station buildings. As regarded the overhead track equipment, 1,488 mast foundations and 252 raking leg foundations had been completed, and 410 masts were erected during May. A preliminary survey of approximately 74 miles for the transmission line had been made, and alterations to several stations had been completed. Arrangements had been made for the erection of electric locomotive running sheds and workshops at Daimana.

TELEGRAPH & TELEPHONE NOTES.

China.—Telegraph and Telephone Extensions.—Extensive plans for the extension of the telegraph and telephone systems are on foot in China, and the posts of superintendents of telegraph lines, which had been abolished, have been restored and 12 new superintendents appointed for various sections throughout the country. The telephone administration at Soochow, Kiangsu, has obtained permission from the Ministry of Communications to lay an underground cable system throughout the city.—*Eastern Engineering.*

Irish Free State.—Underground Telephone Cables.—The Post Office authorities of the Irish Free State have set aside a sum of money for the work of laying telephone wires underground. Almost all the telephone circuits in the Glasnevin portion of the Dublin postal district have already been thus made secure against the damage caused by storms.

Sweden.—Telephone Service.—The Commercial Secretary at Stockholm states that, according to the annual report just published by the Telegraph Administration, the number of telephone apparatus in use throughout the country in 1922 amounted to approximately 394,500, or about 66 telephone instruments to every 1,000 inhabitants. The total number of conversations recorded amounted to 555,205,000, as compared with 538,452,000 in 1921, an increase of 3.1 per cent. The number of subscribers increased from 310,705 to 317,455, a result attributed to reduced subscription rates. On December 31st, 1922, there were 4,143 telephone stations in Sweden,

and the total length of the State telephone conductors was 678,000 kilometres.

Telegraph Service.—In 1922 the Telegraph Administration received by way of income about 76 million kronor, compared with 89 million kr. in 1921 and 77 million kr. in 1920. The reduction in the receipts is due to the lower subscription rates and other reduced charges. At the end of last year there were 3,475 telegraph stations in Sweden. The number of radio-telegraph installations on board ships amounted to 264, and the number of radio stations leased by the Telegraph Administration totalled 209, the fees from which yielded an income of 750,000 kr. The total number of telegrams dispatched amounted to 17,682,385, or a reduction of about 7.6 per cent. since 1921.—*Board of Trade Journal.*

RADIO-TELEGRAPHY AND TELEPHONY.

Australia.—Broadcasting.—Until regulations for radio-broadcasting have been framed, no more licences will be issued to amateur operators in Australia. A few weeks ago a conference of the firms and other bodies likely to be interested in radio-broadcasting was convened by the Postmaster-General (Mr. Gibson) for the purpose of suggesting regulations for the control of broadcasting. The proposed regulations were placed before a committee of the conference at a meeting held *in camera*.

Radio-Broadcasting.—Aberdeen Station.—The studio in connection with the broadcasting station for the North of Scotland, now in course of erection, will be situated in the premises of the Aberdeen Electrical Engineering Co. in Belmont Street.

Sheffield's Relay Station.—We understand from the *Sheffield Daily Independent* that arrangements have been completed between the British Broadcasting Co. and the Sheffield Corporation for the leasing of a site for the proposed relay station on the Tramway Sports Ground at Greenhill, and the land line transmitting station will be in Corporation Street.

Wave Length.—Because reception has been indistinct in distant parts recently, an experiment to see if the trouble can be overcome has been made for a week, commencing on August 10th. The B.B.C. approached the Post Office for permission to increase the wave-length during the morning transmission. It was given, and matter broadcast at 11.30 from London was sent out on a 400-metres instead of a 369-metres wave length.

Sweden.—New Radio Company.—A new company, Svenska Rundradiobolaget, is being founded at Stockholm with a capital of kr. 100,000 minimum and kr. 300,000 maximum. The new concern intends to apply for a broadcasting concession. Among the founders are Allmaenna Telefonaktiebolaget L. M. Ericsson, Allmaenna Svenska Elektriska Aktiebolaget, the A.E.G., and Nordiska Kompaniet.—*Reuter's Trade Service* (Stockholm).

United States.—Radio Patents.—An agreement has been entered into by the Canadian General Electric Co., the Northern Electric Co., the Canadian Westinghouse Co., the Bell Telephone Co. of Canada, and the International Western Electric Co., whereby the respective patents of each concern may be used by all for radio purposes within their natural field of use. The Marconi Co. will have the use of patents for wireless purpoes, the Bell Co. for telephone communication, and manufacturing companies, including the Marconi Co., for the purpose of manufacture and sale.—*Pall Mall Gazette.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Argentina.—Buenos Aires.—September 10th-October 3rd. State Railways. Stores (including telegraph and telephone and electrical materials) for 12 months.*

Australia. — Melbourne. — Commonwealth Government. Various dates. Cable distributing terminals; bells, cords, and plugs; switchboards; telephone parts; motor-generator sets; and submarine cables. (August 3rd.)

August 23rd. Protective apparatus. (August 10th.)

Sydney.—September 19th. New South Wales Government Railways and Tramways. One 7,500-kW frequency changer for White Bay power house. Chief electrical engineer, 61, Hunter Street, Sydney.*

August 30th. Postmaster-General's Department. Motor generators.*

September 24th. Municipal Council. Consumers' meters and sub-station apparatus.* December 3rd. 33,000/5,000-V switchgear and apparatus for sub-stations. November 19th. Step-down transformers.*

Bowen (Queensland).—September 3rd. Municipal Council. Boiler plant, steam-driven electricity generating plant, main switchboard. Messrs. A. E. Harding Frew and T. W. Bridger, consulting engineers, Telegraph Chambers, Queen Street, Brisbane.

Brisbane.—September 19th. Postmaster-General's Department. Telephone apparatus and parts.*

Perth (W.A.).—October 10th. Postmaster-General's Department. Battery plates and wood separators, &c.*

Belgium.—Municipal authorities of Vedrin (Province of Namur). Establishment of an electricity distribution system in the town and also a small transformer station.

August 23rd. Municipal authorities of Schaerbeek, Brussels. 6,000 metres of 3 x 15 x 10 sq. mm. armoured cable.

Bradford.—September 6th. Electricity Department. One surface condensing plant, with auxiliaries. (August 10th.)

Dover.—August 25th. Corporation. 50 tons British Standard tramway rails. Mr. W. B. Smith, borough engineer, Maison Dieu, Dover.

Esthonia.—September 1st. Reval Tramways Administration. Tramway standards.*

Edinburgh.—September 3rd. Electricity Supply Department. Extension of five d.c. feeder panels at Leith sub-station. (See this issue.)

Farnworth.—September 17th. Electricity Department. One 50-kW rotary converter with transformer, switchgear, instruments, cables, &c. (See this issue.)

Fleetwood. — August 27th. Electricity Department. 1,050 yd. cable. (August 10th.)

France.—August 28th. Etablissement Central du Matériel de la Télégraphie Militaire, 51 bis, Boulevard de la Tour Maubourg, Paris. 1,000 metres of light cable.

August 31st. 10 tons of bronze telephone wire, ¼ mm. diameter.

Halifax.—September 7th. Tramways and Electricity Committee. One 10,000-kW turbo-alternator, with condenser. (See this issue.)

Hong-Kong.—The Government of Hong-Kong invites tenders for a concession to run an electric tramway service on certain roads in the Kowloon Peninsula. (August 3rd.)

Irish Free State.—Dublin.—August 27th. Streets Committee. Two 3½-ton electric lorries for house refuse. Supt. of Cleansing, 15, Wood Quay, Dublin.—*Irish Builder and Engineer.*

August 23rd. Electricity and Public Lighting Committee Small overhead gantry crane, or, alternatively, a runway at the electricity works. Mr. J. J. Murphy, Town Clerk.

August 24th. Housing Committee. Wiring for electric lighting in 84 houses on Donnelly Orchard site, Dublin. Specifications from the city electrical engineer.

Waterford. — Young Catholic Men's Society. Electric lighting installation at the Society's hall. The secretary.

Lincolnshire.—Equipment, including plant, electric lighting installation and all accessories, for Lincolnshire Co-operative Bacon Factory, Ltd. B. E. Brighton, secretary, Conningsby, Lincs.

London.—H.M. Office of Works. August 21st. Electrical wiring installation at Somerset House, Strand, W.C. (August 10th.)

Lytham-St. Annes.—August 25th. Electricity Department. E.h.p. cable. (August 10th.)

Macao.—September 15th. The Macao Government invites tenders for the construction and exploitation of a wireless station, electric power machinery, and electric conveyances.

Manchester.—August 21st. Electricity Committee. Constructional steelwork required in erection of new sub-station, Gorton. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

September 15th. Waterworks Committee. One set electrically-driven h.p. centrifugal pumps. (August 10th.)

Merthyr Tydfil.—September 18th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, Clerk, High Street.

Newcastle-under-Lyme.—August 27th. Electricity Department. 3,000 yd. 3-core e.h.p. armoured cable. (August 10th.)

New Zealand. — Wellington.—October 22nd. Public Works Department. One 400-kVA, 3-phase transformer, complete.*

Northern Ireland.—Greenmount (Co. Antrim).—August 21st. Ministry of Finance. Installation of electric lighting at Greenmount Agricultural School. Particulars (20s.) from 15, Donegall Square, West Belfast.—*Irish Builder and Engineer.*

Norwich. — September 11th. Electricity Department. Generating plant in connection with Thorpe power station. (August 10th.)

Plymouth.—September 19th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c., and 1,000-kW converter. (See this issue.)

Pontypridd. — August 27th. Electricity Department. 2,700 yd. 3-core l.p. cable, 2,000 yd. l.p. electric lighting overhead lines. (August 10th.)

Singapore.—September 7th. Municipal Commissioners. 5,000-kW turbo-alternators and condensing plant; water-tube boilers, draught plants, and steel chimney. (August 10th.)

South Africa.—Johannesburg.—September 24th. South African Railways Tender Board. Incandescent lamps.*

September 18th. Municipal Council. One 2,000-kW converter panel, transformers, overhead tramway equipment, and 500 rolled steel tramcar tires.*

Uitenhage, Cape Town.—September 13th. Municipal Council. Electrical plant.*

Uruguay. — Montevideo.—October 15th. Comision del Palacio Legislative. 286 electric light chandeliers and brackets.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen.

Electrical work in connection with the Aberdeen War Memorial Court, Cowdray Hall and Art Museum, and Art Gallery extension (£575).—Mr. Jas. C. Laing.

Belgium.—Belgian State Railway authorities in Brussels last week received seven tenders—five Belgian, one French, and one British (Callender's Cable and Construction Co., Ltd.)—for the supply of 2,000 metres of insulated cable. The lowest offer was that of the Société des Cableries et Corderies du Hainault, of Dour, Belgium.

Birmingham.—Corporation. Accepted:—

Six water-tube boilers, with superheaters, economisers, stokers, and all accessories. (The boilers are for a normal evaporation of 35,000 lb. per hour at 325-lb. steam pressure.)—Vickers-Spearing Boiler Co., Ltd. Suction boiler flue-dust removal plant.—The British Vacuum Cleaner and Engineering Co., Ltd.

Chester.—Board of Guardians. Accepted:—

Rewiring and tubing in connection with the electric lighting installation at one of the Board's institutions. Mr. L. Walworth.

Dumfries.—Town Council. Accepted:—

Rotary converter (£4,658).—Metropolitan-Vickers Electrical Co., Ltd.

Glasgow.—Housing and Town Improvement Committee. Accepted:—

Electric lighting installation at Hawthorn Street housing scheme (£2,048).—Munroe & Co.

Tramways Committee. Accepted:—

Forged mild steel axles.—Glasgow Railway Engineering Co.
Gear wheels and pinions.—British Thomson-Houston Co., Ltd.
Tramcar controllers.—English Electric Co., Ltd.
Centrifugal pump.—British Electric Plant Co.

Town Council. Recommended:—

Electric lighting installation at the extension of Merklands Cattle Wharf (£348).—Haddow & Co., Ltd.

Hastings.—Town Council. Accepted:—

Generating station plant (£40,525).—Brush Electrical Engineering Co., Ltd.

Tiffield.

Installing electrical plant, with battery, and wiring work at the Northamptonshire Training School.—Lowke & Sons, Ltd.

Upton.—Board of Guardians. Accepted:—

Installing electric lighting (£147).—Hall Bros.

Weston-super-Mare.—Urban Council. Accepted:—

Electrical plant for Banwell water works.—Christy Bros. & Co., Ltd.
Diesel engine and pumping plant.—Sulzer Bros.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Requests for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of:—

Nyjmegen automobile lamps.
Entwistle's lubricant (for hydraulic pump leathers).

NOTES.

Correction.—In the Legal Section last week an error occurred in the title of the case reported on page 210. For Charlesworth Hall & Co. read Charlesworth Peebles & Co.

Fatality.—An explosion occurred on August 8th in the electrochemical works of the Marine Arsenal in Toulon while some men were filling bottles with oxygen. Five men were injured.

Glasgow Radio Exhibition.—The first Scottish national radio exhibition will be held at St. Andrews Hall, Glasgow, from September 3rd to 8th, inclusive, when radio apparatus will be exhibited on 40 stands. The exhibition is being organised by the Radio and General Publicity Co. of Glasgow and Manchester.

Tariffs in London and Glasgow.—Mr. J. W. Beauchamp, Secretary and Director of the British Electrical Development Association, writes to *The Times* in reply to a letter comparing charges for electricity in London and Glasgow as follows:—

"Owing to the large number of electricity supply undertakings operating in the London area, both municipal and company, it is hopeless to generalise concerning the charges made. There are districts in London where electricity for lighting is little more than half the figure mentioned by Messrs. George MacLellan & Co., Ltd., of Glasgow; in others again it is sold for heating and cooking at from ½d. to 1½d., with the result that this method of carrying out a great many of the household operations now performed with gas, coal, or elbow grease, is making very rapid advance. The electrical industry is well aware of the great progress made in Glasgow, and looks to that city in this direction, as in so many others, as an example to be watched and followed, but naturally conditions under which different supply undertakings operate vary very widely, and few places in London have quite the opportunities of producing and selling power on the scale which obtains in that northern city."

Mid-Lancashire Electricity District.—At an inquiry by the Electricity Commissioners, held at the Preston Town Hall on July 31st, the object of which was to finally determine the area of the proposed Mid-Lancashire district; the Commissioners sitting were Sir John Snell (presiding), and Mr. H. Booth, with Mr. D. S. Cumberledge (clerk). Mr. T. Rowland Harker represented the Corporations of Accrington, Bacup, Blackburn, Blackpool, Burnley, Colne, Darwen, Haslingden, Lytham, St. Annes, Nelson, Preston and Rawtenstall, and the urban districts of Brierfield and Fleetwood. Mr. Craig Henderson appeared for the Lancashire Power Co. The scheme already published gives effect to the conclusion arrived at by the Commissioners as the outcome of the inquiry held last February.

Mr. Rowland Harker said that the position he occupied was considerably different from that which he held at the first inquiry.

On behalf of the Lancashire County Council, Mr. Bryning pressed for representation on the committee.

Mr. W. S. Weeks, for Clitheroe, thought the representation already decided upon should remain as it was and that local authorities should be represented directly and not through the County Council.

Sir John Snell explained to Mr. Weeks that if his authority applied for a Special Order for electricity supply for all purposes in its own municipal area, and thus became an undertaker, it would become entitled to elect one member.

Mr. Weeks replied that if it did not become an undertaker it preferred direct representation.

Mr. Harker said his authorities would prefer representation to be as agreed in February last. If the County Council were given representation he would suggest that the representative be an "independent" County Councillor, appointed after conference with the Association of Municipal Authorities.

A representative of the Lancashire County Council was provisionally allowed and the Commissioners decided to further consider the question put by Mr. Craig Henderson as to increased representation of the Lancashire Power Co. in case the company should erect another station in the district, as had been contemplated at Padiham.

Mr. Harker argued that any authority, by building another station, might on the same line of argument establish a case for increased representation.

A suggestion put forward by Mr. A. H. Aitkin (Town Clerk of Accrington) that representatives should retire in March, 1925, instead of 1924, was accepted by Sir John Snell.

Mr. Harker said all the authorities he represented were most desirous that there should not be any departure from the technical scheme as originally set out in the order, and the chairman agreed to recommend to the Commissioners the acceptance of the proposition.

Mr. Harker expressed the opinion that difficulty and confusion would arise in the presence of an advisory board as a tribunal of first instance as well as the Commissioners. The contention of the constituent authorities was that they should have been able to go before the Commissioners in the first instance, but that the board should have the opportunity of being heard before the Commissioners. Otherwise, according to the scheme at present, a constituent authority might come before the Commissioners with a recommendation which amounted to a decision of the board adverse to the proposal which it desired to put before the Commissioners.

Mr. Craig Henderson expressed agreement with Mr. Harker, and thought an advisory board should be formed on the basis of each authority having its statutory position preserved, their representatives meeting together and pooling their interests for the common good.

Sir John Snell promised that if the Commissioners found that alterations ought to be made they would be made, and

the proposed amendments would be submitted for the consideration of Mr. Harker's clients, who would be given an opportunity of considering the decision.

Towards the conclusion of the inquiry Sir John Snell said that the week before an application was received by the Commissioners from the Lancashire Power Co. for their consent to the construction of a station at Padiham. That was a matter which closely affected the Burnley Corporation, and no action could be taken without the fullest inquiry.

A communication had been received from Messrs. Leyland Motors, Ltd., with regard to the power station at Farington, and he would pass the detailed statement as to the station in question and its surplus supply to Mr. Harker.

This concluded the inquiry.—*Preston Herald.*

The Location of Submarine Cables and Faults.—Messrs. F. B. Young and W. Jevons describe in the July issue of the I.E.E. *Journal* a method of locating cable faults by means of a pair of towed electrodes, the cable section between fault and shore being energised by alternating or interrupted current. Simple approximate formulæ are derived for the range of the gear, and numerical values are calculated for three typical cables. It is shown that the device should be sufficiently sensitive to locate an earthed break in a modern cable up to 100 nauts from shore and an insulated break up to 400 nauts, though on account of the difficulty of handling the gear in deep water the useful ranges would often be much less.

The apparatus consists of two metallic electrodes, which are towed at the ends of two insulated conductors, of unequal length and twinned throughout their common length, by means of which they are connected through a suitable transformer to a three-valve amplifier. The electrodes may consist of lengths of copper or phosphor-bronze braiding, threaded over the end of the cable and soldered to the conductor. This should be protected by a covering of some stout, porous material, such as hessian or a hemp pile, since friction between the metal and the sea-bottom produces serious electrical disturbances. For maximum sensitivity the towing cable should be loaded with a weight so that the electrodes are towed near the ground.

If an alternating current of audible frequency is passed through the cable the oscillating magnetic field and eddy currents produced round the latter may be detected by means of the electrode circuit. Hence, by towing the electrodes obliquely across the track of the cable and changing course each time the sound heard rises to a maximum, the ship may tack along the cable until the total failure of the signals indicates that the break has been passed.

The towing cables and deck loads must be carefully twinned in order to eliminate as far as possible electromagnetic disturbances which are almost invariably produced by the ship's machinery. These disturbances may, however, be conveniently utilised for testing the condition of the electrode circuit from time to time. Either electrode may be replaced at will by the ship's steel hull, which then forms, together with the remaining electrode and its lead, an inductive circuit whereby the ship's disturbances are picked up. The sensitivity of the detector depends upon the distance between the electrodes, increasing up to a certain limit as that distance is made greater. There is little advantage, if any, in increasing the length beyond 40 or 50 yards. It is quite possible to utilise "leader-gear" coils for the detection of cable faults, but electrodes, on account of their comparative independence of the depth, give a much more extended range. The term "range" denotes the distance from shore up to which the cable may be detected. In view of the very limited currents which are permissible this consideration proves to be of great practical importance. Port-starboard indications, which enable the vessel to follow a more direct course, may be obtained from electrodes by towing two pairs on the ship's quarters.

The first trial was made at the invitation of Messrs. Clark, Forde and Taylor on a cable belonging to the Commercial Cable Co., which had broken near the shore-end at Waterville, Co. Kerry. A special feature of the case was that, owing to the large number of cables converging on Waterville, to drag for any given cable was a delicate and difficult operation. The actual break was located at 1.7 nauts from the supposed position. The significance of this lies in the fact that between the supposed and the actual position of the break the cable was crossed by three more recent cables. Hence the electrode detector undoubtedly saved considerable time and expense.

Another trial was carried out at the invitation of the Telegraph Construction & Maintenance Co. by arrangement with the Commercial Cable Co. off the coast of Co. Kerry. In this case the points indicated by the electrode gear lay consistently to the north of the charted position of the cable, the discrepancy at places amounting to half a mile, and afforded data for the recharting of the position of the cable.

West of Scotland Electricity District.—With regard to the system of electricity supply in connection with the proposed scheme constituting the West of Scotland Electricity District, to be considered at a conference of parties interested, to be held in Glasgow next month, it is proposed that for the generation of electricity the standard shall be three-phase alternating current, and the standard frequency shall be (*a*) in the northern part of the district within the areas of the Glasgow Corporation and of the Clyde Valley Electrical Power Co., excluding the parishes of Erskine, Houston, Kilmalcolm, Kilbarchan, Loch Winnoch, and part of the parish of Neilston, 25 cycles per second; and (*b*) in the remaining part of the district, including the burghs of Greenock and Port Glasgow, the parishes of Erskine, Houston, Kilmalcolm, Loch Winnoch, Kilbarchan, and part of the parish of Neilston, the burgh of Paisley and the whole of the county of Ayr, including the burghs therein, 50 cycles per second. For the transmission of electricity the standard pressures (between phases) shall be, in the case of main transmission lines, 33,000 and 22,000 volts, and in the case of secondary transmission lines 11,000, 6,600 and 3,300 volts. It is proposed that the plant in a number of stations shall be extended from time to time.

Inquest.—On August 9th an inquest was held at Mansfield into the death of Charles Keeling, a welder, who received a fatal electric shock while working inside a boiler. A fellow workman gave evidence to the effect that the deceased was reinforcing parts of the boiler, using an electrode in a "universal" holder. Normally the electrode would have been from 16 to 18 inches from the operator's face, but deceased was found to have received severe burns about the mouth and the back of his neck. Another witness stated that that type of electrode holder had been in use, without a single accident, for three years; deceased was a careful workman. Answering Mr. Swann (representing the Home Office Electrical Department), this witness said that a pressure of 70 V reduced from a supply pressure of 220 V was employed. Mr. Swann pointed out that special precautions had to be observed when the higher voltage was used, and elicited the admission that these precautions had not been taken. The inspector called witness's attention to a small projection of bare metal on either side of the holder, but witness said that the holder was efficiently insulated when issued.

The verdict "Death from electric shock" was returned and the Coroner said that he hoped those concerned would make themselves better acquainted with the regulations.

G.P.O. Assistant Engineers' Examination.—The Civil Service Commissioners announce that an open competitive examination for not fewer than 12 situations as probationary assistant engineers in the Engineer-in-Chief's Department of the General Post Office, will be held in London, commencing on November 6th. Limits of age, 20 and 25, with certain extensions. Regulations and form of application will be sent in response to requests by letter addressed to the Secretary, Civil Service Commission, Burlington Gardens, W.1.

The Post Office states that one of the advantages resulting from the development of the telephone service has been to extend the field of employment, and the number of posts available for young men possessing the necessary qualifications is increasing with the continued growth of the service. The Civil Service Commissioners have therefore arranged to hold another examination, at which the subjects covered will include higher mathematics, electricity, telegraphy, and telephony. The posts offer openings particularly for graduates of technical colleges under the age of 22, with an extension of age for candidates who served with the Forces during the war. Forms of application, to be returned not later than September 6th next, can be obtained from the Civil Service Commission.—*The Times.*

Radio Notes.—Two new radio sets, soon to be in the hands of the engineering staff of Scotland Yard, are the nucleus of a future system of radio communication at present being contemplated by the Metropolitan Police. Experiments with weaker sets have already proved the advantages of radio telephony over any other method of communicating news and instruction to police stations and to Yard officers out in "receiving" motor-cars. The two new transmitting sets will each have a radius of 50 miles. How they will be used—whether both at the Yard or one on a tender—is being considered by Mr. G. A. H. Wootton, the Yard's radio engineer, and Major T. H. Vitty, the police engineer. The Commissioner of Police and the heads of departments concerned are understood to be n favour of the installation of receiving sets in all the metropolitan police stations and in a number of tenders for the use of the "Flying Squad," so that the Yard can get in instant touch with them. The initial cost is, however, important.—*Evening News.*

Fewer American Broadcasting Stations.—Broadcasting is apparently slowing down slightly in the U.S.A., for, says the *Electragist*, the peak of this service was reached in May, when 591 stations were on the lists of the Department of Commerce. On June 30th there were 573, eighteen less than in May, although there were 115 more than in June, 1922. Fifty stations were deleted in June, more than in any other month since the service was undertaken. On June 30th the total of 573 stations was distributed as follows: Class A, 203; Class B, 42; Class C, 327; Class D (development), 1. During June 31 new Class A stations were licensed and one Class B; 27 C's were transferred to Class A, and two were granted Class B licences. In June one Class A station stopped broadcasting and 49 Class C's on 360 metres were deleted.

An Outdoor One-Valve Set.—Tuning in all the broadcasting stations with the aid of only one valve and a frame aerial would have been regarded as impossible a few months ago, yet the feat has been accomplished by a Nottinghamshire experimenter. The complete set is contained in a compact

wooden box, and as the usual bulky accumulator and high-pressure battery are replaced by two dry batteries, the outfit is easily portable. Full constructional details of the set, which employs the Armstrong principle, are given in the August 15th issue of the *Wireless World and Radio Review*. Such a set should prove ideal for outdoor as well as indoor use.

A Petrol-Electric Road Train.—A new petrol-electric road train has lately been produced by the Austro-Daimler Motoren Gesellschaft, of Vienna, Austria. The motive power is supplied by a six-cylinder engine of 150 h.p., coupled direct to a 90-kW direct-current generator, which supplies two electric motors connected with the rear road wheels of the tractor. The trailer, which is intended to carry loads of from 25 to 30 tons, runs on eight wheels mounted on four axles.

Cattle Killed by Shock.—Owing to the falling of a 6,000-V overhead transmission line in a field near Keighley, two cows were killed on August 13th.

Educational.—Germany.—The University of Frankfort-on-Main has established an institute with a professorship which is to deal with the applications of physics in medicine, *e.g.*, radioactivity, X-rays, light rays, and the like. It is stated to be the first institute of the kind to be established in Germany. —*Nature*.

Steam Engineering in Germany.—At the Congresses of the Associations of German Electricity Works and Boiler Inspection Societies, both of which were recently held at Weimar, some interesting points relating to advances in steam engineering were discussed. Under present economic conditions, most German electricity works are compelled to raise, as far as possible, the output of their steam-generating plant, and to reduce fuel consumption to a minimum. This is done by increasing the individual capacity of boilers, engines, and power-houses, as well as by using low-grade fuel and resorting to highly improved thermic processes. Another method employed with promising results is the use of very high steam pressures. As pointed out by Prof. Loschge, of Munich, the capacity of steam boilers can be raised by increasing the grate area and putting it to higher strains. Step grates are best suited for this purpose. The heating surface of such boilers should, of course, be increased considerably, preferably by using vertical-tube boilers. Up to twenty water tubes can be arranged above one another. Successful attempts to raise steam pressures to 60-100 atmos. and thus to improve the thermic efficiency have been made by Herr W. Schmidt, of Cassel, and by the Atmos Company. While thus increasing about 30 per cent. the output of a given power-house, the amount of water contained in the boiler is reduced, which is an undoubted drawback, as it diminishes the ability to deal with abrupt load fluctuations.

As pointed out in a paper by Mr. Noack, a well-known firm of Swiss engineers is installing in a Belgian power-house a turbine designed for 50 atmos. and 450 deg. C. superheat, the thermo-dynamical efficiency having been raised to 24 per cent. An intermediary turbine of standard design is arranged in series with the high-pressure turbine running at very high speed, and the exhaust steam, previous to its entering the standard turbine, undergoes a suitable superheating. Other remarkable turbine installations are the 50,000-kW sets which, according to papers by Herr Th. Reuter and Dr. Th. Meyer, have been designed by the A.E.G. for the Goldenberg electricity works. A new arrangement has in this case been devised for the steam path, the exhaust steam from the auxiliary turbine fed with live steam being led into the condenser rather than into a low-pressure stage of the main turbine.

Interesting results obtained with steam boilers having convex heads, which are now being tested at the Stuttgart Engineering College, were made known by Dr. von Bach. Elliptical boiler heads were found to admit of much higher liquid pressures than the strongly curved heads so far used. Tests of the Dadurf boiler were discussed by Dr. Zwiauer, of Stuttgart. The coal in this type of boiler is burnt on the grate from the top downwards, so that the gases of incomplete combustion, being carried to the hottest layer, are burnt without any separation of soot. The grate consists of water-cooled tubes, the heated water serving to transmit the heat of the fuel to the water to be evaporated.

The cycle thus performed is similar to that obtaining in a low-pressure boiler, the boiler proper being out of contact with the fire gases. In the test referred to, as much as 128 kg. of steam per square metre of heat-absorbing surface was raised, no evidence of imperfect combustion being noted. —*Manchester Guardian*.

A Sensitive Electroscope.—Mr. Takeo Shimizu's electroscope described in the *Japanese Journal of Physics* is a modification of that of Mr. C. T. R. Wilson. It consists of a fine silvered glass fibre suspended freely at the centre and four metallic plates, two large and two small, placed symmetrically on both sides of it. The larger ones are about as long as the fibre and stand vertically facing each other on each side. The smaller ones stand also vertically, but below the locus of the lower end of the fibre at some distance from each other and situated between the fibre and the respective larger plates. The two plates on either side form a single electric system and the two systems are kept at the same potential, while the fibre is charged to a high auxiliary voltage. When the electroscope is to be used one of the systems is isolated and connected to the object. The two inner smaller plates play the part of a stabiliser and a comparatively high sensitivity can be obtained in virtue of their presence. In favourable cases a sensitivity of about 5,000 scale divisions per volt was obtained, although such a sensitivity may not be suited to the deflection method, owing to various difficulties. But as the instrument keeps a very constant zero position by its design, it may be employed as a sensitive zero indicator. The author does not consider the design final; the shape and orientation of the various parts may well be improved. His desire is to obtain an electroscope as sensitive as a quadrant electrometer, thus combining the advantages of the two instruments.

Appointments Vacant.—Three charge engineers (350 taels per month; winding shop assistant (350 taels per month, tael=3s.), for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

Reviews.—Corrigenda.—The following corrections which should have been made in the review of "Atomic Structure and Spectral Lines," on p. 211 of our last issue, were received too late for use:—Line, 8, for liberal read literal; line 35, for Lane read Laue; line 78, for v read ν; line 105, read "He next sets out $p \int dq = nh$"; line 106, for $q\ d\ p$ read q and p; line 115, for $\kappa\ th$ read $k\ th$.

Congress of Engineers at Gothenburg.—At a national congress of engineers, working in fifteen sections, which was opened at Gothenburg on August 8th, an introductory discourse on the conditions of Swedish industrial life was delivered by Chief Engineer M. Svedberg, who pointed out that apart from cultivated land, Sweden's natural resources consisted of forests, ore deposits and water power. As regarded ore, the prospects were very bright, an undiminished export of iron ore being possible for hundreds of years to come. The recently found copper and sulphur deposits would render Sweden to a large extent independent of imports. The total water power available in Sweden was calculated at 6,750,000 turbine h.p., out of which about 1,300,000 h.p. was already exploited, and a further 2,200,000 h.p. could be exploited during the next 40 years. The lecturer emphasised the fact that even if this further exploitation of water power were completed at once it would still be necessary to import about 1,500,000 tons of coal and 90,000 tons of mineral oil. The lecturer, in summing up, said that the most urgent needs of Swedish industry were peace in the labour world, reduced taxes, and lower railway freight rates.—*Reuter's Trade Service*.

Institution of Electrical Engineers.—Coopers Hill War Memorial Prize.—The above prize, which has been founded by members of the Royal Indian Engineering College, Coopers Hill, in commemoration of members of the College who fell during the war, is awarded annually by the Institution of Civil Engineers and triennially in turn by the Institution of Electrical Engineers, the School of Military Engineering, Chatham, and the School of Forestry, Oxford. The prize, which consists of a bronze medal, a parchment certificate of award, and a money prize of the value of about £25, is awarded for the best paper on a professional subject selected by the Council making the award. One of the triennial awards falls this year to the Council of the I.E.E., which has selected for the subject of competitive monographs "An Historical and Critical Survey of Atmospheric Electricity and Protection against Lightning." Papers submitted for the above purpose should reach the secretary of the Institution not later than December 31st, 1923. The I.E.E. award for 1923 is limited to corporate members of the Institution who were under 30 years of age on January 1st, 1923.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

We are informed that Mr. J. H. Crossley, of the Metropolitan-Vickers Electrical Co., Ltd., has been studying industrial electric heating developments in the United States for the purpose of promoting such business in England. After electrifying a number of producer gas ovens in the main plant of the Metropolitan-Vickers Co., to be used for demonstration and testing purposes, as well as for the regular manufacturing processes of the company, Mr. Crossley will deliver lectures on the advantages of electrical heating in the various industrial centres of England. Mr. Crossley was sent to America in 1921 by the Metropolitan-Vickers Co. to make a number of special investigations. In

January, 1923, he was instructed to begin an intensive study of electric heating and spent four months investigating the methods of manufacturing industrial heating apparatus in the shops of the Westinghouse Co. and the methods of operating this apparatus in factories in various parts of the country. On May 18th he sailed for England from Quebec, but three days later his ship was wrecked off the coast of Newfoundland. He and his wife escaped with their lives, but all Mr. Crossley's notes, photographs, and reports, were lost, and it was necessary for him to return to America to duplicate as best he could in a short time this lost material. Mr. Crossley sailed for England once more on July 13th.

Horsham Urban District Council has increased the salary of Mr. F. French, the electrical engineer, by £50 a year, as from the beginning of October next.

Mr. W. J. Cridge, the representative of the Leicestershire and Warwickshire Electric Power Co., has taken up his residence at Coalville, says the *Leicester Mail*, and has opened an office at 1, Station Chambers, High Street, in connection with the company's electric light and power scheme for Coalville and district.

Mr. Turnbull C. Alexander has joined the outside sales staff of Messrs. Paterson & Service, Glasgow, as their district engineer representative.

The marriage took place at Wolverhampton, on July 31st, of Mr. John Ernest Bennett, A.M.I.E.E., of Aigburth, Liverpool, and Miss Flossie Garnett.

Electrico, Ltd., of Old Christchurch Road, Bournemouth, advises us that Mr. Edgar Graves, until recently on its staff, is no longer representing the company.

When Mr. E. Moxon was appointed electrical engineer of Southport, it was agreed by the Electricity Committee that if he "made good" his salary should be revised accordingly. The Electricity Committee has recently been considering the matter and has come to the conclusion that Mr. Moxon's salary be advanced from £800 to £1,000 a year. The Finance Committee, however, is of the opinion that the salary should be increased by £100 this year and another £100 next year. The matter was to have been raised at Tuesday's meeting of the Town Council on the recommendation of the Finance Committee.

Colonel A. G. Stevenson, who was officer-in-charge of electrical machinery at the Aldershot military power station when it was first established, has now returned as chief engineer of the command. Captain A. J. Mayne, who has just completed 25 years as chief electrical engineer to the command, has received a present as a testimonial of the good feeling of the staff.

Mr. R. Leach, A.M.I.E.E., has resigned his position as sales engineer for Lancashire and Yorkshire and the adjacent counties with Messrs. Ferguson, Pailin, Ltd., and has taken up an appointment with Messrs. Johnson & Phillips, Ltd., as chief assistant to the manager of their switchgear department.

The Maidenhead Town Council has granted honoraria of £25 each to Mr. J. Dowsett, assistant engineer, and Mr. W. Shervell, station superintendent, in recognition of their services during the illness of the borough electrical engineer.

Messrs. Frank Craft (Castleford), Ltd., who secured the contract for the electric lighting of twelve schools for the West Ham Corporation in May last, inform us that the staff engaged on the work has been reorganised, and Mr. Albert E. Short, A.M.I.E.E., has been appointed general manager.

Mr. Alderman T. E. Lowe, who has been for the past 22 years chairman of the gas and electricity departments of the Burton Town Council, has resigned from the Council owing to ill-health.

NEW COMPANIES REGISTERED.

City of Wells and District Electricity Supply Co., Ltd. (191,672).—Registered August 1st. Capital, £15,000 in £1 shares. To adopt agreements (1) with Sanders, Kennedy & Co., Ltd., for the sale and transfer of the benefit of a lighting contract with the Corporation of the City of Wells, on payment of £100 expenses; (2) with the said company, appointing them engineers; and (3) with A. H. Taylor for the sale and purchase for £90 of a plot of freehold land required for the erection of the company's generating station, and to carry on the business of electricians, engineers, manufacturers and workers of, and dealers in electricity, motive power, and light, &c. The first directors are:—H. Clark, Keward House, Wells; A. J. Clare, Market Place, Wells; R. J. Marsh, New Street, Wells; A. H. Taylor, High Street, Wells; E. G. Pringle, Glen Cottage, Wells; H. A. Sanders, "Ballure," Stoddens Road, Burnham-on-Sea. Minimum cash subscription, £6,000. Qualification, £100. Registered office: 25, Market Place, Wells, Somerset.

North of England Engineering and Electrical Co., Ltd. (191,682). Private company. Registered August 1st. Capital, £1,000 in £1 shares. To carry on the business of general and electrical engineers, &c. The first directors are:—W. S. Gibson, 101, Cambridge Road, Middlesbrough (director of North of England Cinema, Ltd., and Palladium (Hartlepool), Ltd.); E. E. Porter, 38, Southfield Road, Middlesbrough (director of Palladium (Hartlepool), Ltd., and Coatham Hydro, Ltd.); T. Thompson, Allbury House, Surbiton, Surrey (director of North of England Cinema, Ltd., and Palladium (Hartlepool), Ltd.). Qualification, £100. Remuneration as fixed by the company. Secretary: E. Porter. Registered office: 125, Albert Road, Middlesbrough.

Radio Supplies, Ltd. (191,811).—Private company. Registered August 8th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers of, and dealers in wireless telegraphs and telephones and all component parts thereof, &c., and to adopt an agreement with P. Alexander and C. W. C. Beckman. The permanent directors are:—P. Alexander, "The Pines," Monivea Road, Beckenham, Kent; C. W. C. Beckman, 28, Springfield Avenue, Muswell Hill, N.10. Qualification, 150 shares. Registered office: 234, High Holborn, W.C.1.

Wessex Electrical Supplies, Ltd. (191,748).—Private company. Registered August 3rd. Capital, £1,000 in £1 shares. To carry on the business indicated by the title. The first directors are:—J. P. Southwell, 38, The Ridgway, Golder's Green, N.; F. W. Barker, 20, Enmore Road, Putney, S.W.15; H. May-Todd, 23, Queen's Road, Erith. Registered office: St. Benet Chambers, Fenchurch Street, E.C.3.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Manáos Tramways and Light Co., Ltd.—C. H. Julius, of 9, Cloak Lane, Cannon Street, E.C., ceased to act as receiver and manager as from August 1st, pursuant to an Order of Court dated July 19th, 1923.

British Wireless Supply Co., Ltd.—L. Nicholas, of 15, Springfield Mount, Leeds, was appointed receiver on July 24th, 1923, under powers contained in debentures dated October 19th, 1922.

Aladdin Lamps (Midlands), Ltd.—E. Shaw, of 10, Cock Street, Liverpool, was appointed receiver and manager on July 31st, 1923, under powers contained in debenture dated September 20th, 1921.

A. E. Acton-Burnell, Ltd.—Particulars filed of £2,463 18s. 7d. debentures authorised July 24th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Phillips Valves, Ltd.—Particulars filed of £2,000 debentures authorised July 19th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,998.

R. J. Richardson & Co. (London), Ltd.—Particulars filed of £250 debentures authorised July 27th, 1923, charged on the company's undertaking and assets, present and future, including uncalled capital, the whole amount being now issued.

London Telegraph Training College, Ltd.—Particulars filed of £1,000 debentures authorised July 9th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £950.

Urban Electric Supply Co., Ltd.—Trust deed dated July 27th, 1923, to secure £350,000 5½ per cent. mortgage debenture stock, with power to issue a further £150,000 ranking *pari passu* therewith, constituting a specific charge on freehold and leasehold land and buildings, present and future, with plant, machinery, and fixtures thereon, and a floating charge on the company's other property, present and future, including uncalled capital, but the company is not to create any mortgage or charge in priority to, or *pari passu* with the stock, except for dealing in favour of the bankers' mortgages or charges for securing payment to them of advances not exceeding £50,000 at any time. Trustees: Trustee Corporation, Ltd.

Northwich Electric Supply Co., Ltd.—Letter of deposit dated July 30th, 1923, charged on various freehold premises in Northwich, &c., to secure all moneys due or to become due from company to Westminster Bank, Ltd.

Torpoint Electric Supply Co., Ltd.—Satisfaction in full on June 28th, 1923, of debenture dated February 5th, 1917, securing £1,089.

Dodd & Oulton, Ltd.—Satisfaction in full on August 1st, 1923, of debentures dated July 1st, 1920, securing £5,000.

British Electric Transformer Co., Ltd. (76,351).—Return dated May 15th, 1923. Capital, £1,000,000 in 300,000 preference and 700,000 ordinary shares of £1 each. 300,000 preference and 325,000 ordinary shares taken up. £539,821 paid on 290,776 preference and 249,045 ordinary shares. £85,179 considered as paid on 9,224 preference and 75,955 ordinary shares. Mortgages and charges, nil.

Indo-European Telegraph Co., Ltd. (3,953).—Return dated May 9th, 1923. Capital, £450,000 in £25 shares. 17,000 shares taken up. £425,000 paid. Mortgages and charges, nil.

United River Plate Telephone Co., Ltd. (23,654).—Return dated June 26th, 1923. Capital, £3,000,000 in 540,000 ordinary, 40,000 preference, and 20,000 unissued shares of £5 each. All the ordinary and preference shares taken up. £2,830,000 paid on 524,000 ordinary and 40,000 preference shares. £80,000 considered as paid on 16,000 ordinary shares. Mortgages and charges, £300,000.

United Electric Tramways of Montevideo, Ltd. (80,456).—Return dated June 29th, 1923. Capital, £1,000,000 in 100,000 preference and 100,000 ordinary shares of £5 each. All shares taken up. £295,105 paid on 26,221 preference and 32,800 ordinary shares. £704,895 considered as paid on 73,779 preference and 67,200 ordinary shares. Mortgages and charges, £920,979.

Ilfracombe Electric Light and Power Co., Ltd. (71,378).—Return dated May 28th, 1923. Capital, £15,000 in £5 shares. All shares taken up. £15,000 paid. Mortgages and charges, nil.

CITY NOTES.

Consolidated Electrical Co., Ltd.

At the meeting held on Tuesday, says the *Financial Times*, the Chairman said that for the last few years they seemed to have been gradually drifting from bad to worse, and the virtual disappearance of their principal assets, the Anglo-Portuguese Telephone shares, had left them in the position when they had to seriously consider whether the company could any longer be carried on to the advantage of the shareholders. He expressed the view that there was no prospect of reconstruction, and so they were left with winding-up as the only course open to them. His feeling was that in the autumn there should be a general meeting at which, unless some better proposal was forthcoming, formal resolutions should be submitted for winding-up and distributing the assets as far as possible in cash.

Western Union Telegraph Co.—The figures for the first six months' working this year show an increase in the net income of well over a million pounds. The *Financial Times* gives the following details:—

Gross revenues, including dividends and interest $56,097,327, total expenses $48,141,299, balance $7,956,028, deduct interest on bonded debt $1,153,425, net income $6,802,603.

C. A. Vandervell & Co., Ltd.—The report for the year ended March 31st shows a loss of £18,110, which, it is stated, is more than accounted for by the sale of the company's factories at Brighton. An adverse balance of £264,016 was brought into the accounts, and there is therefore a loss of £282,126 to carry forward.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 1¼ per cent. in respect of the half-year ended July 31st.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted:

Tottenham District Light, Heat, and Power.—£100,000 "B" consolidated stock (3½ per cent. stand.).

STOCKS AND SHARES.

TUESDAY EVENING.

THE paramount influence in the Stock Exchange markets is, naturally, the effect of the British Note on the question of the Ruhr occupation. It came as a surprise. Stock Exchange criticism has been for months past directed to the want of firmness displayed by the British Government, and the Note is therefore welcomed by reason of the stronger tone which it imports into this country's policy. Investment securities accordingly show up well. "Money" stocks—those of the fixed-interest variety—further improved upon the good prices previously ruling. Conversely, the more speculative issues gave way, as happens invariably when there are international complications afoot. In the market for electrical descriptions, the chief feature is a general recovery amongst the cable stocks.

Eastern Telegraph ordinary, after its fall of 13½ points, has rallied 8; Globes, Westerns and Eastern Extensions are all 5s. better. The wireless scare is once more over, but the cable market will be susceptible to these alarums and excursions whenever the newer system comes more prominently into the limelight. It has always been contended here, of course, that there is plenty of scope, plenty of traffic, for both submarine and wireless, but the investor—even in such solid securities as cable stocks—is liable to an occasional wave of apprehension. Marconi shares are quiet at 2 5/16. Radio Common remain dull at 13s. 3d., the preferred being a better market at 15s. Marconi debentures strengthened to 106½.

Electricity Supply shares are as firm as ever, the political troubles affecting them not at all. County ordinary have risen to 40s. and City Lights to 2 7/16. Charing Cross at 11¼ recovered their dividend of 5s. per share. Metropolitans at 31s. 10½d. are ex dividend. Edmundsons at 3½ show a gain of the fraction. English Electric 6 per cent. debentures keep good at 5 premium. Electric Supply Corporation 6 per cent. preference are a shade under their par price. Enfield Ediswan 7½ per cent. preference hardened to 6d. discount. South Wales Power 6 per cent. debentures are ½ discount, and the new Tokio 6 per cent. debenture is steady at 5s. premium, after a brief relapse to ½ discount.

There appears to be a very good chance of the London electricity companies having their tenure extended for a further period of forty years from 1931 when, under the original concessions, their maturity arrives, and they could be taken over upon terms that are none too clearly defined. Within the past few weeks, negotiations have arrived at such a stage as enables the holder of shares in the London undertakings to feel that, barring unexpected accidents, there is every reasonable chance of his investment remaining undisturbed until 1971—a date which, for some of us, has little more than an academic interest. This prospect of security it is which emphasises the confidence felt in the industry, and which renders all the pleasanter the remarkably good dividends paid on the ordinary shares.

The manufacturing group is uninteresting. Callender's are 1/16 lower at 2 7/16. British Aluminium lost sixpence. Babcock & Wilcox came on offer from the provinces and eased off to 2½.

Underground Electric Railways are in considerable favour. The income bonds tread closely upon the heels of par. The £10 shares are 5s. better at 2½, and the shilling shares show a sixpenny advance. Districts, throwing off recent dulness, are again up to 48½. The foreign group is heavy. Mexicans are unable to go ahead while there overhangs the Utility Companies the fear of heavier taxation. Mexico Tramways fives are 2 down. Mexican Light & Power issues have failed to regain the losses of the last few weeks. Anglo-Argentine Trams and Brazilian Tractions are reactionary.

Rubber shares maintain their newly-found resiliency, the price of the produce keeping good on American purchases. The Armament list is attracting no particular attention.

SHARE LIST OF ELECTRICAL COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Aug. 14, 1923.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary	£1	12	12	1 1/16	—	£6 2 6
Charing Cross Ordinary	£5	9	14	11¼xd	+ ¼	6 4 5
do. do. do. 4½ Pref.	£5	4½	4½	4¼xd	—	5 6 0
Chelsea	£1	6	10	34/-	—	5 17 8
City of London	£1	14	15	2 1/8	+ 1/16	6 3 0
do. do. 6 % Pref.	£1	6	6	24/-	—	5 4 4
County of London	£1	8	10	2	+ 1/16	5 0 0
do. do. 6 % Pref.	£1	6	6	23/9	—	5 1 1
Edmundson's Ordinary	£3	Nil	7	3½	+ ⅛	6 15 7
do. 6 % Pref	£5	12/-	6	4⅞	—	6 8 0
Kensington Ordinary	£5	10	12	9⅜	—	6 11 4
London Electric	£3	4	10	4½	—	7 1 7
do. do. 6 % Pref.	£5	6	6	5⅜	—	5 11 7
Metropolitan	£1	7	8½	1 1/16xd	—	5 6 3
do. 4½ % Pref.	£1	4½	4½	17/6	—	5 1 5
Newcastle-on-Tyne Ordinary	£1	Nil	2½	17/-	—	2 18 10
do. 5 % Pref.	£1	5	5	16/3	—	6 3 1
do. 7 % Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6 % Pref.	£10	6	6	9½	—	6 9 9
North Met. Elec. 6 % Pref.	£1	6	6	22/-	—	5 9 1
Urban Ordinary	£1	Nil	—	15/-	—	Nil
do. 5 % Pref.	£1	2½	5	18/9	—	6 8 0
St. James' and Pall Mall	£5	12	14½	11¼	—	6 3 6
South London	£1	7	10	1⅜	—	5 14 4
South Metropolitan Pref.	£1	7	7	1¼	—	5 12 0
Westminster Ordinary	£5	10	12	9½	—	6 9 9
Whitehall Elec. Invst., 7½ % Pf.	£1	7½	7½	19/9	—	7 13 10
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	74	—	5 8 1
Metropolitan	,,	2½	3½	66½	—	5 2 2
do. District	,,	1	3	48½	+1	6 3 9
Underground Electric Ordinary	£10	Nil	Nil	2⅝	+ ⅛	Nil
do. do. "A"	£1	Nil	Nil	8/6	+6d.	Nil
do. do. Income	Stock	4	5	99	+1	*5 1 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—1	5 18 10
do. Def.	,,	1½	34/6	23	—	6 10 5
Chile Telephone	£5	6	6	6⅛	—	4 18 0
Cuba Sub. Ord.	£10	7	7	7⅛	—	9 6 8
Eastern Extension	£10	10	10	17½	+ ½	5 16 0
Eastern Tel. Ord.	Stock	10	10	178	+8	5 15 7
Globe Tel. and T. Ord.	£10	10	10	17½	+ ½	5 16 0
do. do. Pref.	£10	6	6	11	—	5 6 6
Great Northern Tel.	£10	24	22	27	—	8 1 6
Indo-European	£25	10	7	33½	—	5 4 6
Marconi	£1	25	15	2 1/16	—	6 9 10
Oriental Telephone Ord.	£1	12	12	1⅞	—	*6 8 0
United R. Plate Tel.	£5	8	8	6⅞	— ⅛	*5 13 6
West India and Panama	£10	Nil	Nil	1/6	—	Nil
Western Telegraph	£10	10	10	17½	+ ½	*5 16 0
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams. First Pref.	£5	5⅛	12½	3	— 1/16	9 3 4
do. do. 2nd Pref.	£5	Nil	5⅛	2 7/16	— ⅛	11 5 8
do. do. 5% Deb.	Stock	£5	£5	72½	—	6 18 6
British Electric Traction Ord.	,,	4½	5	70½	—	6 16 1
do. do. 6% Pref.	,,	6	6	100	—	6 0 0
Brazil Tractions	£100	Nil	4	49	— ½	8 3 4
Brit. Columbia Elec. Rly. Pcc.	Stock	£5	£5	86½	—	*5 15 7
do. do. Preferred	,,	£5	96/-	81⅛	—	*5 18 9
do. do. Deferred	,,	£3	127/-	89⅛	—	*7 2 6
do. do. Deb.	,,	4½	4½	81	—	*5 5 0
Lond. & Sub. Trac. 5 % Pref.	£1	3½	£5	9/6	—	10 10 6
London United Tram. Deb.	Stock	£4	£4	61½	—	6 10 0
Mexico Trams 5 % Bonds	—	Nil	Nil	74	—2	6 15 2
do. 6 % Bonds	—	Nil	Nil	56½	—	Nil
Mexican Light Common	£100	Nil	Nil	25½	—	Nil
do. Pref.	£100	Nil	Nil	52	—	Nil
do. 1st Bonds	—	Nil	£5	61½xd	—	£8 2 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	£15	£20	2⅛	— 1/16	£4 14 1
British Aluminium Ord.	£1	£10	£5	18/3	—6d.	£5 9 7
British Insulated Ord.	£1	£15	£15	2 1/16	—	£6 5 0
Callenders	£1	£15	£15	2 7/16	— 1/16	£6 3 0
do. 6½ Pref.	£1	6½	6½	23/9	—	£5 9 5
Crompton Ord.	£1	£10	£5	7/16	—	£8 17 6
Edison-Swan	£1	£10	Nil	4/3	—	Nil
do. do. 5% Deb.	Stock	£5	£5	65	—	£7 13 10
Electric Construction	£1	£10	£10	1 1/16	—	£6 16 1
English Electric	£1	£8	£5	17/9	—	£5 12 9
do. do. Pref.	£1	£6	£6	19/-	—	£6 6 4
Gen. Elec. Pref.	£1	6½	6½	23/3	—	£5 11 10
do. Ord.	£1	£10	£5	18/6	—	£5 8 1
Henley	£1	£15	£15	2 1/16	—	£6 9 10
do. 4½ Pref.	£5	4½	4½	4⅜	—	£5 2 10
India-Rubber	£1	£10	—	7/16	—	—
Met.-Vickers Pref.	£2	£8	£8	2½	—	£6 8 0
Siemens Ord.	£1	£10	£10	1½	—	Nil
Telegraph Con.	£12	£20	£20	£5	—	*£4 17 0

* Dividends paid free of Income Tax.

WATER-POWER STUDIES.—V.*

Reporting on a Water-Power Project.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., M.Am.Soc.C.E.

In carrying out *complete* investigations of a water-power project, the *independent* investigating engineer of to-day has developed into almost as versatile a character as a film-star actor. Entirely independent of his abilities as an engineer, he may suddenly be confronted with a different language which he must quickly know something about, he must know how to ride a horse and a cycle, to shoot straight, to drive a car, to swim, to cook a meal, and do pioneer work of any kind; he must be a fairly good photographer; able to do his own type-writing, and, among other equally desirable requirements, he must possess the ability to digest (in another language) the most important advantages and disadvantages of and determine the legal possession of water, land and other rights, &c., &c. And, as regards the drawing up of the report, this report must be logically arranged, reliable in principle and technical detail, easily understood, and be profusely illustrated by means of good descriptive maps and photographs, &c. Usually when Government carries out investigatory work of this nature, several men and/or departments are engaged, and matters in general are very much simplified. The best examples of investigatory work are to be found in Canada and the U.S.A.; the former country is particularly well advanced at the present time. About the close of the Great War, the Government of this country made a start in this direction, temporarily appointing a few consulting engineers (specially experienced in local water supply studies) to estimate the probable power available as determined from a general knowledge of the characteristics, &c., of the chosen catchments and of the total precipitation thereon, making allowance for a safe total loss factor, and applying a reasonably safe run-off coefficient. The uncertainty of this method with its involved assumptions is obvious to all. In certain far-off countries where stream gauging has not been carried on or where stream flow measurements have been taken haphazard and are considered unsafe, the independent investigating engineer (not a Government Department) usually has a lengthy and sometimes hard problem before him in arriving at, what may be called, a reasonably safe run-off value by this method. In every case where stream flow measurements have been *regularly* taken over a period of years, they should be used in preference to any known method of estimating the probable flow from the relationship of precipitation and run-off, or used in conjunction therewith. Calculations depend primarily not upon the precipitation, although this is the original source, but upon the flow (at the point of diversion) of the particular stream or river under investigation. In making the best use of the relationship method mentioned here, it is well to remember that usually the larger the catchment area the lower will be the unit run-off for a relatively short period of time, that the yield of the larger catchment is more steady and will suffer less draught, that the hourly or daily discharge ratio for maximum to minimum will decrease with increased size of catchment area, that the run-off coefficient of relation may vary widely for the different gauging stations, and that, as the catchment area and average yield increase, there is usually a decrease in the coefficient of variability, &c.

Sometimes, as the result of a rather short reconnaissance survey, a reasonably accurate estimate can be made of the probable amount of power available, &c.; however, the general conclusions reached by such a relatively rough method can never be comparable with the results obtained from careful observations of stream flow extending over a period of seven, ten, or more years.

Isolated and "odd" stream flow measurements are practically useless (sometimes positively dangerous) unless the seasonal time of the year and/or the stage of the stream (at the time the respective stream flow measurements are made) known. Very careful measurements of stream flow extending over many years' time are usually necessary to enable a really good estimate of the maximum dependable available power to be made, this generally bearing more importance where the development is without storage or pondage features, *i.e.*, for "*base*" *power* development only. Measurements of discharge made at the two extreme stages (low flow and flood flow), with mention of seasonal time, &c., are of special importance. But a more exact knowledge of the available power for *maximum* development, and its relation with the ordinary minimum flow, is certainly of very great importance.

In the original stage of a proposed development, it is often evident that a water-power project (or a similar one over the same reach) has already been studied, and the reason it has reached its present stage, for financial consideration, is generally because it appears to be a satisfactory one and worth taking up. After making investigations, usually a report is prepared which might or might not in a very comprehensive manner include the following principal requirements: (*a*) Preliminary reconnaissance survey; (*b*) flow, power, and cost estimates; and (*c*) information of the probable power market. It is often in such a form that a proposed scheme is first made known. Nevertheless, no matter how well the report might appear to be in this or any form, the common stand taken is that all information, figures, values, &c., originally put forward as to the probable power capable of development, the estimated yield from the catchment and/or from storage or pondage possibilities, the estimated absolute minimum, ordinary and dependable flow at the proposed site, the estimates of costs of total hydraulic works, &c., estimates of the power market capable of development within a reasonable distance and for a good shaped area, and the estimate of the total production cost, &c., &c., *all* require checking before acceptance or before money can be "written off" by any financial party. Neglecting design and construction, perhaps the worst blunders of the past have been those due to *over*-estimation of run-off from the catchment, and *under*-estimation of total capital costs and total production costs, and therefore, from this viewpoint only, there will always exist the necessity for checking a report (requiring an independent investigation) with, usually the principal object of determining the cost per e.h.p. capable of being developed and delivered, at a competitive price, to a reasonably well assured market offering a satisfactory load factor. The report (to be checked) would receive more attention and support if accompanied by good maps and photographs and a longitudinal section plan (plan and profile) showing an actual survey of the reach (taken from below the power-house site to a point well above the diversion or headworks site), which would indicate the best site for the diversion and/or headworks, the best alignment of the conduit, the best location of the forebay, the best alignment for pressure pipe line, the best power-house site, and the best alignment of tail-race (if of any great length). Any alternative sites or scheme on the reach should be indicated in different colours, dot-dash or distinguishing lines. The report should show all necessary detail sufficiently accurately to enable a check to be made of the existing estimates of *costs* already drawn up for the complete hydro-electric development. If the *main* report is bulky, a valuable appendix accompanying the report would be a summarisation of the main report on the lines

*Previous articles in this series appeared in the ELECTRICAL REVIEW of February 2nd and 9th, March 16th and 23rd, June 15th and 22nd, and July 13th and 20th, 1923.

of that given at the end of this text. The engineer, chosen by the financiers to check the report, should preferably be a man trained and/or experienced in all the various phases of hydro-electric power investigation and analysis, construction and operation.

Briefly, an economical water-power development depends upon the available *flow*, the *head*, the *cost*, and the *power market*. Hence, three of the principal conditions to be determined as accurately as possible to bring about the desired economic results are, apart from cost: (1) A reliable hydrometric survey and analysis of the conditions of the stream or river under investigation; (2) reliable knowledge of the net static head; and (3) reliable estimates of the load factor and character of the load curves. The commercial value of any water power would also depend very much upon the size of, and in general, the shape of the power market available for selling energy, the proximity of this market, and also on the initial cost of the total development. To market the output from most water-power developments (which are usually situated in a remote part of the country), certain favourable rates must be offered which will interest several different classes of possible *bulk power* consumers. Broadly, the classes of consumers directly interested would be:—

(*a*) Those who contemplate installing steam or other fuel generating stations within commercial distance.

(*b*) Those industrial establishments and mills now buying energy from competitive undertakings.

(*c*) Those already operating isolated plants of almost any size, but more particularly the medium and large size of plants.

(*d*) Those who contemplate using the bulk of energy generated for their own use in chemical or other works, or for replacement of or use as auxiliary power from a municipal or company fuel generating station. Usually, to render economical supply to power consumers and to enter the power market on a proper basis, it is necessary to make a careful study of the available market with the object of gaining definitely reliable knowledge on such matters as the:—

(1) Class of power consumers (tramway, industrial, lighting, &c.).

(2) Present total costs of operating existing isolated plants and/or class (1) for municipal or company undertaking.

(3) Amount of power required.

(4) Hours of operation (constant or/and intermittent).

(5) Load factor and diversity of maximum loads.

(6) Proper and safe basis of respective power and energy sales to possible big consumers in particular.

(7) *Mean* unit selling price of energy at the consumers' terminals.

(8) Relative local generation production costs compared with (7), &c.

The future of this country (in particular) offers a very wide field for comprehensive studies along these lines. The first start in this direction may emanate from the recent issue of the North Wales-Cheshire area. Speaking in general terms, this condition for other countries is neither novel nor advantageous to the industries and public unless existing supply companies are allowed to favourably compete (without restriction) in the mean unit selling price of energy to every possible consumer within the licensed and/or respective areas. The crux of the problem will be *lowest price per unit and best supply of energy free from interruptions*; the consumer will certainly have little or no further interest in the matter unless it be to his advantage, such as that of aiding phase compensation.

Generally speaking, at the present time there are no really good relatively cheap (commercial) water-power projects going begging. Water power in abundance can, of course, be found in many countries, but it is not commercially good or it is not worth developing at the moment unless, perhaps, for the express purpose of "cornering" a concession for future profitable use. Where schemes have been studied in a preliminary way, then, assuming the concessions and the cost of land and other rights to be satisfactory and the power market good, one may be assured (from the information usually contained in the text of the water permit) that a hydrological investigation or hydrometric survey is worth while. Usually the first study undertaken is that of the stream flow and water power obtainable, as more often mistakes are made in this direction. However, conditions, requirements, and circumstances usually decide the best method of procedure in the preparation of or checking of a water-power investigation and a report thereon. A new or competing power market and the distance therefrom may decide against a project.

The scope or extent of water-power investigations differ materially as a result of all manner of conditions, natural and otherwise; moreover, there is a very wide difference in the manner different engineers draw up their reports. Thus, for a given project, one may see fit to omit certain data requiring unnecessary expense and time to ascertain and actually not required for the time being, while another investigator may elaborate on that very point and go into unnecessary detail at the expense of other matters equally or more important for the moment. This may be due to the engineers concerned having had special or specific kinds of training and experience, but more often it is due to lack of knowledge in field investigations and/or to insufficient practical experience in the construction and operation of distinct types of water-power undertakings. Another engineer might consider it necessary (and possibly would if the studies happened to be under Government control and expense) to make a thorough investigation and study so as to involve geology, meteorology, the legal and commercial aspects, &c.; carry out an exhaustive study of the control of the entire stream showing how the best use can be made of land and water rights, &c.; thoroughly discuss the type of structures for different parts of the hydraulic and electrical works, supports, &c.; discuss the advantage of different sizes, shapes and capacities, &c., and the best type of works, plant, equipment and auxiliaries; present a detailed analysis, and give mathematical deductions and tabulated results of every important factor entering into the development; discuss the productive, commercial and administrative details, &c., and have the report accompanied by an excellent display of maps, and so forth.* With regard to the scope or extent of investigation, its manner of attack, and its magnitude as regards the amount of detail on every point concerned (considered very necessary and sufficient by one, but too much or too little by others) there is ample need for the engineers concerned to get together and present their views. At the present time it is recognised that in most countries, engineers have no established *set* form, method, classification or practice in the matter of water-power investigations and/or the drawing up of reports. A water supply engineer or a qualified hydro-electric engineer might submit a very different report to that of a turbine maker.

Hydro-electric projects vary all the way from a simple scheme to a highly complicated and very extensive scheme. In the one case we may have all necessary stream flow records at hand, a scheme offering cheap land and water rights, and so concentrated that the entire development and the whole power market are located within the space of a few acres of ground; and the whole scheme may be financed with "cheap" money. On the other hand, we may have very unreliable, or poor, hydrological records, or none at all; a scheme involving large and costly lands and rights and so situated as to involve complicated storage features; uncertain foundations for dam or a difficult and expensive diversion structure; long conduit requiring different and expensive sections such as siphons, aqueducts, tunnels, &c.; somewhat inaccessible route and bad ground along the route; expensively built-up forebay site; long pressure pipe line on a doubtful hillside; expensive excavations for power house, very inaccessible;

*An independent investigating engineer is usually limited in the extent of investigatory work and analysis by expense and other considerations.

long and costly tail-race; long transmission lines running in different directions to the prospective power markets; expensive wayleaves; uncertain power market in an area already supplied and with prospect of a rather slow growth; a scheme financed with "dear" money; vested interests in opposition; and a scheme burdened at the outset with a costly Parliamentary Bill, &c. It is therefore obvious that the extent or scope of investigatory work must vary with the character, &c., of the project, quite independently of the different views, &c., mentioned in the last paragraph. Nevertheless, a water-power report would usually involve the study of such main features as the:

(1) Class of report to be prepared; (2) investigation and analysis of all necessary field information, including absolute reliability of records; (3) planning of the proposed development along the most economical lines, mainly with regard to first cost; (4) modifications (with comparative costs) due to storage or pondage; (5) estimates of power available and production costs; (6) study of power market; (7) financial considerations, &c. The investigation of the power available and production costs may resolve itself into: (*a*) a complete compilation of all available rainfall and run-off records applicable to the case; (*b*) a study of the reliability of these records; (*c*) a determination of the most probable run-off for typical years; (*d*) possible modification of flow estimates due to available economical pondage or storage; (*e*) estimates of the power available (with and without storage or pondage); (*f*) a study of the available and probable market, primarily to determine and plot the load curves; (*g*) estimates of financial returns for *various operating conditions*.

With this information at hand (preferably showing formulæ and methods used) and, bearing in mind that the whole scheme is to be planned along the most economical lines, it might be desirable, perhaps very necessary, to prepare estimates in sufficient detail giving: (A) the most economical plant or development capacity; (B) maximum uniform load which can be depended upon at all times; (C) length of time that other loads will be available, these loads varying between (B) and the plant capacity; (D) expected energy output corresponding to (B) and (C); (E) financial returns when these conditions are met, &c.

Within the space allowed here, it is not possible to treat in detail of all the different features which enter into or may be required for every class of water-power project and report. Considering the principal technical details only, the body of the *main* report should contain the fullest possible information of the technical features of the whole project, and the report should always be accompanied by good up-to-date maps and photographs, giving necessary physical data. The preliminary technical details covered by the *main* report would usually include:—

1. Statement of the catchment and its geology, topography, precipitation, run-off, storage features, and the water supply (absolute, ordinary, and dependable flow with and without storage), &c.

2. Statement of the main storage giving location of dam, foundations, height and length of dam, type of structure, nature of bottom of and extent of land submerged, storage capacity, &c.

3. Statement as to how the *head* was determined, whether by means of level, contour-map, actual measurements or by aneroid; stating gross and net head available.

4. Statement dealing with headworks and diversion, giving (*a*) location and accessibility; (*b*) notes on the geologic and topographic features; (*c*) type of headworks and diversion; (*d*) means proposed for regulating water supply before its entrance into the developed waterways.

5. Statement as to (*a*) effect of eliminating (by cutting across, &c.) long tortuous reaches, bends and so forth, showing financial advantages, &c.; (*b*) concrete lining of certain bad reaches of the stream where it is known that loss of water occurs or where the coefficient of roughness is excessive; (*c*) approximate velocity of flow, near and at the site of diversion for low water and for flood water levels; (*d*) nature of stream-bed and banks along the reach, but more particularly for a short distance above and at the diversion site.

6. Statement dealing with forebay, giving (*a*) suitability of site as regards economy and capacity; (*b*) probable capacity for pondage and regulating purposes; (*c*) accessibility and nature of land submerged; (*d*) type of construction proposed and relative amount and cost of rock-cut, excavation and/or fill, &c.

7. Statement of pressure pipe line, giving (*a*) accessibility and suitability of hillside; (*b*) number of lines and type of pipe or pipes proposed; (*c*) approximate length of different pipe sections, their thicknesses and respective diameters; (*d*) total length of pipe line; (*e*) character and amount of load for which each pipe line is intended; (*f*) most important details of pipe line, its foundation, backing, anchorage, &c.

8. Statement dealing with power house, giving (*a*) height above bed of stream; (*b*) height above stream water level at low and flood-water gauge heights; (*c*) suitability as to nature of ground and its extent; (*d*) accessibility of site to good roads and railroad or navigable river; (*e*) type of structure; (*f*) type and capacity of plant (hydraulic and electrical), equipment and auxiliaries, &c.

9. Statement dealing with the tail-race, giving (*a*) probable restricted discharge area in a state of nature; (*b*) restricted discharge area anticipated by the location of hydraulic works; (*c*) length and type of tail-race from power house to the stream, showing approximate amount and cost of rock cut and excavation.

(To be concluded.)

NOTES ON THE DESIGN OF A NEW LINE OF MACHINES.

By S. BALDWIN, A.M.I.E.E.

It sometimes happens that during the development of a line of machines, one or two sizes of that line have to be rushed through for exhibition purposes.

Now, it is perfectly evident, even to the uninitiated, that rush methods are inconsistent with good design; nevertheless, those machines for exhibition must be put through with all possible speed, at the same time being typical of the general design of the whole line. Consequently they must embody all the salient features so as to be thoroughly representative.

These machines should be manufactured as cheaply as possible, so that any alteration that it may be desirable to make later, when the other sizes of the line have been developed, may be made with the least possible expense. In a word, they should be considered strictly as experimental machines, and manufactured accordingly.

Expensive patterns, tools, jigs, &c., should not even be thought of. The design and instructions to the works should be such that the final alterations can be carried out with the minimum amount of expense.

Patterns should be of the cheapest possible grade. Stucco patterns are admirably suited for this purpose. Sometimes a slight alteration to an existing pattern will suffice; and the pattern, after the casting has been made, should be immediately returned to its original dimensions.

Necessary tools should be conjunction tools. It will pay, at this juncture, to use several existing tools rather than make up a new one or more.

If the above procedure be adopted, the designer will

have a freer hand, and will be enabled to give of his best, without being restricted in any way. He will be able to save many patterns, tools, &c., and it will naturally follow that many parts will be eliminated and others made common.

The writer has put through many lines of machines on the general principle outlined above, with the utmost satisfaction to all concerned. He has also witnessed the opposite method of designing one machine at a time without due consideration being given to all the other sizes and making the final patterns, tools, jigs, &c., for these machines as developed, with disastrous results.

He has been led to publish the foregoing considerations in the hope that they may be useful to those employed in, or responsible for, the design, either electrical or mechanical, or both, of any complete range of machines.

Consideration in particular has been given to electrical machines, but the same remarks apply equally well to any other type. The writer would welcome criticism, for he believes there are still reputable firms which carry out an almost exactly converse procedure.

ELECTRICITY IN FACTORIES AND WORKSHOPS.

H.M. Inspector's Annual Report.

(*Concluded from p.* 231.)

The report of the Senior Medical Inspector, Dr. T. M. Legge, C.B.E., indicates that of the total of 247 (26 fatal) cases of lead poisoning, 32 (non fatal) occurred in the electric accumulator industry, being a reduction of three as compared with 1921.

In the general report it is pointed out that there is evidence that the importance of good lighting and its effects upon both the health and safety of the workers is being realised, and that more consideration is being given to suitable methods of lighting adapted to the varying nature of the work.

The publication during the year of the third report of the Departmental Committee on Lighting in Factories and Workshops has stimulated interest in the subject, and the recommendations contained therein have formed the basis of discussion at some meetings of the Joint Industrial Councils, a notable example being the Hosiery Joint Industrial Council; several processes in this industry have been classified in the report as "fine" or "very fine" work requiring specially good lighting. The employers' representatives considered that not only in the workers' interests, but in their own, the report should receive careful consideration. The workers' representatives appreciated this, and enlarged upon the effects arising in many instances from lack of attention to this important matter. They admitted that some manufacturers spent a considerable amount of money on their lighting installations, but urged that others had done very little, and added that it was not so much a case of spending a great deal of money as of making the best use of what was spent. This is really the key to the situation; vast sums are spent on installations, and much money is wasted on brilliant lighting, ill-adapted to the particular work, and many manufacturers could no doubt reduce their lighting bills by half, and at the same time have more satisfactory results, if they studied the question carefully and went into all the essential details.

Mr. T. C. Taylor (Leicester), for example, reports that lamps are installed without any thought being given to the result, except to dispel the darkness that would otherwise exist, and he describes a good example of this in a newly-erected factory only partially occupied:—

> In one very large room, devoid of workers or machines, and where there is still uncertainty about their positions, the lighting consists of several rows of pendent electric lamps stretching from end to end of the room. The casual illuminating effect would be very great, but I am sure it would be impossible to find any point where the effect of the glare could be avoided, and yet it would be nearly impossible to place a machine where a real concentrated light could be thrown on the work. Better effects could, I am certain, be achieved by using half the light with properly-disposed lamps.

The post-war shortening of hours and the continuance of "summer time" have reduced to a minimum the time during which artificial light is necessary in modern factories where natural light is satisfactory, but there remain in use many buildings where artificial light is necessary, except on the brightest days, and there are also the continuous process industries where cases of defective lighting by night are often found.

An interesting result of improved methods of lighting is reported by Mr. Rees (Wrexham) in a silk factory, where girls are employed examining skeins to detect faulty threads. Electric lamps with shallow shades were provided for every two or three workers, at points just above their heads; the glare from these inadequately shaded lamps was found to irritate the eyes, and to cause a drop in the quality of the work. The lamps were raised to the ceiling and proper shades and reflectors provided, with the result that glare has been avoided, and there is a marked improvement in the work.

Several inspectors comment on the trying effects of glare and the need for more attention to shading, especially since the use of the gasfilled lamp has become general. Mr. Smith (Leeds) reports that the comparative merits of direct as against semi-direct lighting were recently tested at an engineering works in two similar but separate departments of the works. Diffused light was more acceptable to the workers, although the ordinary observer preferred the direct light. Other instances of increased attention and care in selecting the best possible means of lighting for the work are given by Miss Coombes, who found in a hat and cap factory in London that the indirect electric lighting installed to replace gas-jets was unsuitable for certain classes of work, *e.g.*, examining and matching colours, and for this work small lamps, with green cone shades, have been introduced. Miss Coombes also found in an incandescent gas mantle factory, where very good light is essential—very fine work being done, picking up stitches in the early stages of manufacture of silk mantles—powerful electric lights suspended over the benches, fitted with wide white enamel shades. In the final burning, where there is considerable heat and glare, an excellent anti-glare screen had been erected, consisting of thick anti-glare glass in front and a lining of mica.

The use of "artificial daylight" lamps appears to be increasing; they are said to be of great value for colour work and work involving the matching of colours.

Some inspectors comment on the absence of evidence of accidents attributable to faulty or insufficient lighting, but it seems possible that the majority of these occur in that large group of accidents due to falls, which will be investigated during certain months of the current year, with special reference to lighting, and much valuable evidence may be forthcoming.

Mr. Chandler (Sheffield) mentions one serious accident, due to a fall, which occurred in a large steel founding shop, where the globe of a big arc lamp was broken. An operative was climbing up a vertical ladder to his overhead crane when he grasped at a deceptive shadow cast by the broken lamp, thinking it was a rung of the ladder, and fell 25 ft. to the floor. This instance emphasises the need of attention being given to the upkeep and maintenance of lamps, a matter that is very often overlooked, especially as regards the cleaning of globes and shades.

The number of registered factories in Great Britain has increased from 135,356 to 137,858, but an almost equivalent decrease has taken place in the number of workshops (including men's workshops), which has fallen from 148,266 to 145,684. The increase in factories is therefore attributable probably, mainly to the conversion of workshops into factories through the introduction of electric or other mechanical power.

ELECTRICITY IN CANADA.

The fifth annual report upon the central stations of Canada, covering the year 1921, has recently been published by the Dominion Bureau of Statistics.

The preponderance of water power makes the report, in effect, a *résumé* of hydro-electric activity during the year. The preface states that "over 90 per cent. of the prime motive power of the central electric station industry of Canada is hydro power." A table shows that at ordinary minimum flow the available 24-hour power, at 80 per cent. efficiency, is 18,255,316 h.p.; at the estimated flow for maximum development (dependable for six months) there is 32,075,998 h.p. available; and the turbine installations at the end of the year aggregated 2,973,759 h.p., showing a very wide margin for further development.

The general report states that the effect of the industrial depression was not felt so severely as in the majority of other industries. The power consumption showed a decline of 5 per cent., but revenues from lighting and power showed increases of 13 per cent. and 10 per cent. respectively. The revenue from lighting is about half the total revenue (excluding the revenue from electricity interchanged between stations), and since the lighting load is not greatly affected by short industrial depressions, it is a very stabilising factor in the industry.

In the five years 1917-1921 the number of stations increased from 666 to 857; in 1921, 38 stations were added. Of the total 259 were hydraulic, 251 fuel-operated, and 347 non-generating stations, representing a total capital investment of $484,665,451. The total capacity of prime movers installed at the end of 1921 was 1,977,857 h.p., divided as follows:—Water wheels and turbines (604), 1,826,357 h.p.; steam reciprocating engines (187), 45,450 h.p.; steam turbines (43), 90,705 h.p.; and gas and oil engines (203), 15,345 h.p. The generating capacity aggregated 1,475,610 kVA, and consisted of 841 alternators with an output of 1,464,022 kVA, and 172 d.c. generators representing 11,588 kVA.

The energy generated during 1921 amounted to 5,614,132,000

kWh; owing to intersales it is difficult to state the quantity sold. The revenue for the year was $73,376,580 (lighting $28,797,359, other purposes $44,579,221), and the total expenses amounted to $47,044,503. It is interesting to note that fuel accounted for only $3,024,930 of this total. It is shown that the revenue received by hydro-electric undertakings amounted to .663 cent per kWh; by steam engine undertakings, 4.815 cents; and by internal-combustion engine undertakings, 8.93 cents. The large hydraulic stations from their very size have a steadier load throughout the day and also throughout the year. They can therefore use their equipment more nearly to capacity than the other stations. It is also a more or less general practice of the hydraulic stations to sell power at off-peak periods at lower rates, which lowers the average revenue per kWh sold. It is not so practicable for fuel stations to do this on account of their higher operating expenses. The statistics show that the large water-wheels are in Ontario and Quebec, whereas the greater number of large steam engines and turbines are in Saskatchewan and Alberta, and over half of the internal-combustion engines are in Saskatchewan.

The plant installed is classified in some detail, and it is seen that of the total of 604 water-wheels and turbines, 221 are of less than 500 h.p. capacity. The greatest amount of energy is generated by the 10,000-15,000-h.p. class, in which there are 49 machines. Above 15,000 h.p. there are 28 machines generating 487,500 h.p. Among the steam turbines those developing between 2,000 and 5,000 h.p. predominate, and produce more than half of the total power generated in this way. As regards generators, it is shown that the bulk of the power is produced by machines ranging from 1,000 to 15,000 kVA, although there are 745 machines of capacities below this range, and only three above.

The extent to which overhead distribution is employed in the Dominion is apparent from the figures showing the pole-line mileage; the total is 21,714, almost half of which is in Ontario.

The statistics presented are all divided up according to the ten provinces of Canada, and in every case the predominant position occupied by Ontario is demonstrated. For instance, the amount of power generated in Ontario is almost exactly half of the total, although the plant installed in the province is about 41.3 per cent. of the total.

During 1921 the energy exported to the United States amounted to 885,248,604 kWh, of which over half was from stations at Niagara Falls, Ontario. The imports were small, the only important instance being that of the St. Clair Tunnel Co., at Sarnia, Ont., which took from 165,000 to 200,000 kWh per month.

Several important works were under way and completed during the year, the largest being the Queenston station of the Hydro-Electric Power Commission of Ontario, which, however, had only one set installed in 1921. The Commission's Nipigon plant (25,000 h.p.) was an addition, and the Laurentide Company installed a 22,000-h.p. turbine at Grand Mere, Quebec, following it by a similar set in 1922. Another important addition was the development of 13,800 h.p. at Winnipeg, Manitoba, and there were numerous smaller installations throughout the country.

AN ELECTROCHEMICAL INTERPRETATION OF SHOCK AND EXHAUSTION.

Man—An Electrochemical Mechanism?

On the final day (July 20th) of the Congress of the International Society of Surgery, Dr. George W. Crile, of Cleveland, U.S.A., read a paper in which he gave an electrotechnical interpretation of shock and exhaustion. He elaborated a theory that man and animals are electrochemical mechanisms constructed on the pattern of the constituent cells, each of which in itself is an electrochemical mechanism. The difference in potential, he said—according to the *British Medical Journal*, from which the following details are abstracted—was maintained by oxidation.

Each living cell consisted of two parts—the nucleus and the cell body—separated from each other by a selective semi-permeable membrane. The nucleus and body could not best be stained by the same medium, the one taking most successfully an acid stain, the other an alkali. The content of each, in the main, consisted of colloidal solutions. Two colloids of different reactions, separated from each other by a semi-permeable membrane, constituted an electric cell. Measurement of the electrical conductivity of organs indicated that the first effect of stimulation within the organism was a slight decrease in the conductivity of the liver, followed by a rapid continuous rise in that organ as the state of exhaustion approached; a slight and prompt increase in the conductivity of the cerebellum followed by a gradual continuous fall; a relatively slower increase in the conductivity of the cerebrum followed by a gradual continuous decrease. Intracellular histological changes following excitation and exhaustion were paralleled by changes in electrical conductivity. Changes in the temperature of organs bore due relation to these facts. For instance, motor activity, either voluntary or produced by direct electrical stimulation of a nerve, was accompanied by rapid alteration in the temperature of the brain and liver corresponding to phases of muscular activity—these alterations, however, being in opposite directions. Water was essential to the activity of the cell. Oxygen, the "acid-maker," was also essential. Oxidation produced acids, and these acids produced the essential alterations in the difference of potential between the nucleus and the cell body, and probably between parts within the cytoplasm, as the result of which accumulations of acid an adaptive discharge of energy was provided. Water carried the oxygen in solution to the cells, dissolved the acid by-products of oxidation and bore them away from the cells. Thus it constantly restored the acid-alkali balance, which was as constantly altered by the acidulating oxidation. Since oxidation in the brain was the highest, the oxidation electric wave would pass down the nerves from the area of higher potential in the brain to the area of lower potential in the muscles and glands, and since the liver had the lowest rate of oxidation—hence the lowest potential—the current would finally reach that area, whence it would return through the electrolytic system to the brain, thus completing the circuit.

The following facts were interpreted by the hypothesis that the body as a whole was an electrochemical mechanism, the positive pole being the brain; the negative the liver; the connecting wires the nerves; the salts in solution the electrolytic fluid in which the electrochemical mechanism was immersed.

(*a*) When either pole—that is, the liver or the brain—was removed or destroyed, the organism perished.

(*b*) If the difference in potential within the cells, no less than the difference in potential between the poles (the liver and the brain), was dependent on the supply of electricity by oxidation, then, if the organism was deprived of oxygen, the existing difference in potential within the cells and within the organs was lost and equilibrium or death was established.

(*c*) Since the speed of chemical action and the electric conductivity were fundamentally controlled by heat and cold, it followed that in an electro-chemical mechanism there must be an optimum temperature as well as a lethal cold and a lethal warm temperature. Abdominal surgery in the colder months in unwarmed front area huts illustrated this point by a forbiddng mortality rate.

(*d*) The opposite effects of stimulation and of exhaustion on the temperature and on the electrical conductivity of the brain and of the liver, the muscles and other tissues in the splanchnic area would be explained by the conception that the driving power depended upon the difference in potential between the brain and the liver, muscles and other organs. Hence, if a stimulus caused only the potential of the brain to rise and the liver remained unchanged, the difference in potential, hence the driving power, would be correspondingly less.

All these conceptions had a practical application in the treatment of shock. For the last two years treatment of patients in their clinic had been based upon the supposition that the difference in potential between the nucleus and the cytoplasm of the cells, as well as between the essential organs of the electrochemical system, must be maintained.

Thus with reference to operative shock every patient should be treated individually. The practical application of the above principles was thus achieved. In "bad risk" cases nitrous oxide-oxygen analgesia (not anæsthesia) was employed together with local anæsthesia. The trauma of the operation was divided. In cases of hyperthyroidism, if the operation produced an exacerbation of the symptoms the operation was stopped at any point, the wound packed open with flavine or sterile gauze, and closure delayed. Water was urged by every route, and to ensure the readiest possible hydration of the cells, 3,000 c.cm. were routinely given by hypodermoclysis by Bartlett's method. Oxygenation of the cells was promoted by the transfusion of whole blood before operation, during operation, and after operation, according to the indication. To assure the maintenance of an adequate circulation—which was essential to the supply of water and oxygen to the cells—digitalis was administered as a routine in those cases in which the myocardium was impaired, a condition most commonly seen in cases of hyperthyroidism. Rest and sleep were promoted by control of the environment and by narcotics, except in the presence of an already depressed liver function, as in jaundice, for the function of both the brain and the liver was depressed by narcotics, especially by morphine. In abdominal cases moist hot packs were applied immediately after operation for the support of the liver cells. The environment of the patient was controlled from his entrance to his exit from the hospital. With the gradual extension of the application of these measures based upon the electrochemical conception, the mortality rate of every type of case had been diminished, and the operability had been extended until now no case was considered inoperable unless the stage of final dissolution was initiated.

"Exide" Battery Service Depôts.—The Chloride Electrical Storage Co., Ltd., has issued an up-to-date list of places in Great Britain and Ireland and many foreign countries where "Exide" service may be obtained. The possession of this booklet should give the battery-user a feeling of safety.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY IN JULY, 1923.

From the figures given in the accompanying table it will be noticed that in the month of July there were decreases in all three divisions of our external electrical trade, but no safe deduction can be made from the returns as they relate to a period when the strike of dockers caused many vessels to lie unloaded. Only six items in the export list showed increases, but one of these, "Other motors and generators," was large. Cable of all classes showed a considerable falling-off and were the main cause of the net decrease. Electrical machinery upon the whole showed a satisfactory increase, a fall in unenumerated electrical machinery failing to counteract the increases in the other items.

The electrical export totals for the first seven months of 1922 and 1923 were:—

Exports.

	1922.	1923.
Electrical goods and apparatus ...	£4,243,449	£4,733,719
Electrical machinery	£2,719,556	£2,256,646
Totals for seven months	£6,963,005	£6,990,365

The fall in imports was heavy. It was distributed over practically the whole of the items, although there were small increases in insulated wires and cables, batteries and accumulators and carbons. The bulk of the decrease, however, was accounted for by a fall of £83,274 in electrical machinery imports, the next highest items being unenumerated electrical goods and apparatus, non-submarine telegraph and telephone wires and cables, and telephone and telegraph instruments and apparatus. The electrical import figures for the first seven months of 1922 and 1923 were:—

Imports.

	1922.	1923.
Electrical goods and apparatus ...	£725,477	£1,254,750
Electrical machinery	736,842	605,865
Totals for seven months	£1,462,319	£1,860,615

The re-exports were a good deal lower, principally owing to falls in the values of re-exported unenumerated electrical goods and apparatus, unenumerated machinery, and telegraph and telephone apparatus.

	Exports.				Imports.				Re-Exports.			
	Electrical exports for July, 1923.	Inc. or dec. as compared with June, 1923.		Inc. or dec. as compared with July, 1922.	Electrical imports for July, 1923.	Inc. or dec. as compared with June, 1923.		Inc. or dec. as compared with July, 1922.	Electrical re-exports for July 1923.	Inc. or dec. as compared with June, 1923.		Inc. or dec. as compared with July, 1922.
Electrical goods and apparatus (unenumerated)	£118,644	− £11,438		+ £32,476	£61,564	− £16,875		+ £25,582	£3,505	− £1,986		+ £243
Insulated wires and cables ...	113,526	− 21,630		− 25,062	18,379	+ 1,023		+ 7,041	113	− 49		+ 77
Glow lamps	25,211	− 5,788		+ 5,720	9,807	− 332		− 3,163	767	+ 450		+ 551
Arc lamps and parts	1,215	− 1,055		+ 535	1,778	− 396		+ 850	—	—		—
Batteries and accumulators ...	45,319	+ 1,990		+ 1,689	10,121	+ 4,908		+ 6,530	3	+ 3		− 92
Meters and instruments ...	24,781	− 3,188		+ 7,656	5,985	− 2,292		− 163	348	+ 68		− 2,435
Carbons	9,253	+ 4,811		+ 5,699	5,746	+ 1,351		+ 2,541	10	− 77		− 249
Electrical Machinery—												
Electrical machinery (unenumerated)	110,398	− 12,564		− 6,637	5,745	− 83,274		− 22,320	8,081	− 4,607		+ 1,670
Railway and tramway motors	30,152	+ 2,975		+ 9,558	—	—		—	—	—		—
Other motors and generators ...	171,614	+ 46,837		+ 35,602	—	—		—	—	—		—
Switchboards (not telegraph or telephone)...	11,054	+ 1,976		+ 5,165	—	—		− 280	—	− 33		—
Telegraph and Telephone Cable and Material—												
Telegraph and telephone wires and cables (not submarine)	53,135	− 19,721		− 8,621	1,902	− 7,379		− 108	2,071	+ 1,429		+ 1,404
Submarine telegraph and telephone cable	38,063	− 13,167		+ 13,953	—	—		—	—	—		—
Telegraph and telephone instruments and apparatus ...	146,886	+ 1,382		+ 11,613	33,875	− 10,378		− 10	523	− 1,984		− 994
Totals	£899,251	− £27,580		+ £89,336	£154,902	−£113,644		− £30,077	£15,421	−£6,786		+ £175
Increase or decrease for the seven months ended July, 1923 ...	Exports. + £27,360				Imports. + £398,296				Re-exports. − £16,382			

RADIO "ATMOSPHERIC" ELIMINATION.

The Marrec Selective Receiving Apparatus.

Everyone who listens with a radio receiver has been compelled to make the acquaintance of the "wireless parasite." This enemy of radio reception, better known to most people by the name "atmospheric," has been investigated by radio engineers ever since radio telegraphy was first introduced and many efforts have been made to eliminate it from the receiver, but only partial success has been achieved.

Under the auspices of the British Radio Research Board experiments have been conducted over a long period in order to study the nature of these parasites. In the August 1st and 8th issues of the *Wireless World and Radio Review*, Mr. Watson Watt describes this work and shows how interesting a study it can be made. It is shown how these parasites may be photographed and how they may be divided up into distinct families and types. These investigations, it is hoped, may assist considerably in the elimination of this kind of interference in reception, because an intimate knowledge of the nature of the disturbance will prove a great aid in solving the most serious problem in radio communication.

By the courtesy of the same journal we are able to abstract portions of the text of a short paper that was read by Mons. Y. Marrec, a French radio engineer, prior to a demonstration of his anti-atmospheric apparatus at a recent meeting of the Radio Society of Great Britain.

The author explained that he has come to the conclusion that atmospherics act by shock exitation on all wave collectors, and cause them to oscillate at their own natural period, and this irrespective of whether they are frame aerials or open aerials.

It is evident that the effect of atmospherics on a directional aerial will be less marked if the atmospherics are travelling in a direction perpendicular to this orientation, but nevertheless the action of atmospherics on the antenna will still be far greater than the signals, and will continue to cause the antenna to oscillate at its natural period.

In order to communicate in certain predetermined directions, elimination of atmospherics has been attempted by the use of combinations of wave collectors, which would be acted upon in different ways by atmospherics and by the signals.

But it is M. Marrec's opinion that the solution of the problem will not be found by such combinations. He maintains that any system which has any chance of increasing the selectivity of reception must satisfy the following conditions:—

(1) Receive the greatest amount of current with the smallest amount of distortion.

(2) Increase the amplification of detected currents without altering their shape. In this case it is necessary to use aperiodic amplifiers in order to limit the amplitude of atmospherics and bring them as near as possible to the amplitude of the signals which it is desired to receive, and without reducing too much the amplitude of the latter.

After this it is necessary to filter the currents by using a series of circuits unsuitable for all currents not having the periodicity of the signals to be received, so that, for an equal amplitude, only signals will be received.

This system is employed in the apparatus which he demonstrated, using a frame aerial, whilst no doubt with a suitable antenna still better results could have been obtained.

The author said, *inter alia*, "For my demonstration I have adapted my anti-atmospheric system to an ordinary five-valve apparatus of my make, to which I have added a low-frequency amplifier to enable me to record the received signals, but the anti-atmospheric apparatus proper can be adapted conveniently behind any other system of reception without any alteration.

"My receiving apparatus consists of two stages of high-frequency amplification, tuned by variable condensers to the wavelength it is desired to receive, a detector and two stages of low-frequency amplification. Following this usual system is the anti-atmospheric apparatus consisting of three valves utilising aperiodic transformers, the filament resistance of these valves being used to lower the saturation point and thus limit the amplitude of the atmospherics. As by this reduction of filament current one reduces also the amplifying power, one recovers this reduction by adding further stages of amplification. This would not be necessary if one could use a limiting device which did not reduce the intensity of the reception.

"Following the apparatus already mentioned, I use three stages of resonance low-frequency amplification, tuned to the note to be received. These circuits are controlled by another filament resistance. This resonance group is used not as an amplifier proper, but as a filter to separate the atmospherics which have a different note from the signals.

"A switch enables one to receive directly or to make use of the anti-atmospheric apparatus at will. In addition, a three-stage low-frequency amplifier is used with a Siemens relay and, finally, the Morse inker.

"Before starting my demonstration I desire to draw attention to the effect caused by atmospherics on such a system. You will be able to observe that between the signals the atmospherics are nil, but that on signals only atmospherics cause breaks if they occur at the same time. The recording strip will, therefore, not show any atmospherics, and if the signals are broken one can remedy this to a great extent by tuning to the spacing wave of transmitting stations using such an arrangement. In this case the spacing wave will be picked up on another set tuned to the spacing note and working another recorder. Also in this case we may have breaks on the inverse signals which will be recorded on the strip by signals corresponding to the spacing. If, for example, in the case of direct manipulation one cannot read 50 per cent. of the signals, in the case of the recording of the spacing we shall also have 50 per cent. of unredable signals, but as the atmospherics acting on these different wavelengths occur at different times, the unreadable signals in one system will not occur together, and therefore one inscription can be used to correct the other. I can therefore double the efficiency of my apparatus when dealing with a transmitting station employing spacing waves, and I believe I am improving very considerably the efficiency of any ordinary apparatus for all other c.w. transmission not using the spacing wave system."

Messrs. Marrec, Ltd., afforded us an opportunity some time ago of privately inspecting the apparatus, which was then installed in one of the busiest parts of London under which heavy electric trains were running at frequent intervals. The examination took place on a sunny morning—a time when the atmospheric conditions are acknowledged to be far from ideal—but the device received loud and distinct messages from both American and Continental stations, and seemed to solve successfully the dual difficulty of eliminating parasitic noises and "filtering" one of two messages that happened to be transmitted on very similar wavelengths. The printing of the message is in itself a distinct improvement, for natural and artificial interference has hitherto resulted in the reception of disjointed messages only. Moreover, it is claimed that the Marrec apparatus enables messages to be transmitted from four to six times faster than has hitherto been possible with assured correctness.

It should be added that, while the circuit provides a means of receiving continuous-wave messages with a minimum of interference from spark signals and atmospherics, it is not applicable to the reception of broadcast matter, as the principle involved is note selection. The demonstration, from a practical point of view, was a distinct success and the results obtained were certainly striking.

A Large Electric Boiler.—The use of excess hydro-electric power for the generation of steam has received a new exemplification at the mills of the Brown Co., Berlin, N.H., where the Electric Furnace Construction Co., of Philadelphia has installed an electro-steam boiler rated at 18,000 kW, and operating at 22,000 volts, three-phase, 60 cycles, with a steam pressure of 135 lb. gauge. The boiler consists of three single-phase tanks. This is said to be the only boiler ever installed to operate at so high a voltage, and, according to the manufacturer, the results obtained from its use are remarkably gratifying.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

19,397. "Dynamo-electric driving sets for motor vehicles." F. Porsche. July 28th. (Austria, July 29th, 1922.)
19,405. "Electric kettles, &c." British Electric Transformer Co., Ltd., and E. Ellwood. July 28th.
19,411. "Tubing for electric lighting, &c." J. N. Hewett. July 28th.
19,431. "Emergency brake for electric trams, &c." T. Jones. July 30th.
19,437. "Devices for protecting telephone, &c., instruments against lightning, &c." A. E. Beattie. July 30th.
19,439. "Attachment for wireless receiving installation to reduce interference." J. F. Johnston. July 30th.
19,455. "Alternating electric current induction meters." O. T. Blathy. July 30th. (Hungary, July 29th, 1922.)
19,446. "Electric switch." G. Sandwell and R. C. B. Stillman. July 30th.
19,452. "Alternating current commutator machines." F. Creedy. July 30th.
19,455. "Telephone exchange systems." Coventry Automatic Telephones, Ltd. (R. C. Arter). July 30th.
19,480. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 30th. (United States, August 25th, 1922.)
19,481. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 30th. (United States, December 16th, 1922.)
19,486. "Means for regulating voltage of alternating electric supply systems." British Electric Transformer Co., Ltd., and A. C. Whish. July 30th.
19,488. "Electric heaters." Bastian Meter Co., Ltd., and A. E. Salisbury. July 30th.
19,493. "Radio telegraphy, &c." T. L. Eckersley, H. J. Round, and G. M. Wright. July 30th.
19,496. "Indicating and recording instruments." J. Abady, J. F. Simmance, and F. Wood. July 30th.
19,499. "Glow cathode rectifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 30th. (Holland, July 31st, 1922.)
19,500. "Loud-speaking apparatus." British Thomson-Houston Co., Ltd. July 30th. (United States, September 13th, 1922.)
19,505. "Electric fire." H. H. Berry and J. W. Reid. July 30th.
19,518. "Apparatus for displaying illuminated advertisements, &c." F. M. Lennard and V. G. Steer. July 30th. (Australia, October 20th, 1922.)
19,521. "Electric condensers." F. N. Coni. July 30th.
19,524. "Wireless receiving apparatus." H. A. P. Littledale. July 30th.
19,528. "Fixing electric cables." J. C. White. July 30th.
19,536. "Electric safety lamps for mines." L. L. Williams and V. L. Williams. July 30th.
19,545. "Ear-piece holder for telephone instrument." G. C. Salsbury. July 31st.
19,549. "Electric burglar-alarm systems." W. Draper and T. Fairlie. July 31st.
19,552. "Device for securing electric lamp bulbs in holders." C. Collingwood, D. H. Lee, and G. Smith. July 31st.
19,578. "Direct-current electric motors." H. Cooth. July 31st.
19,583. "Telephone apparatus." H. Caen. July 31st.
19,586. "Unloaded telephone circuits, &c." A. C. Bartlett and General Electric Co., Ltd. July 31st.
19,587. "Manufacture of electrodes for tungsten arc lamps." General Electric Co., Ltd. July 31st. (Germany, December 22nd, 1922.)
19,596. "Telephonic systems." W. J. Mellersh-Jackson (International Callophone Corporation). July 31st.
19,606. "Electrolytic recovery of zinc from zinc-bearing ores, &c." Electrolytic Zinc Co., of Australasia, Ltd. July 31st. (Australia, August 8th, 1922.)
19,607. "Electric time switch." P. W. Baker. July 31st.
19,608. "Electric resistance welding." C. A. Hadley and Rose Street Foundry & Enginering Co., Ltd. July 31st.
19,610. "Ignition magnetos." British Thomson-Houston Co., Ltd., and A. P. Young. July 31st.
19,617. "Electrodes for thermionic tubes." Dr. E. F. Huth Ges. July 31st. (Germany, August 9th, 1922.)
19,619. "Driving mechanism for electric rail-cars." K. W. G. J. Stoffels. July 31st. (Holland, August 1st, 1922.)
19,620. "Electric horns." W. J. Gooderidge. July 31st.
19,625. "Automatic switching system." A. Barnay. July 31st.
19,635. "Thermionic valve coupling." J. W. Hall and H. V. Montagu Harrison. July 31st.
19,636. "Terminals for electric conductors." D. E. Barnett. July 31st.
19,638. "Tramway crossings." Aciéries de Gennevilliers. July 31st. (France, August 29th, 1922.)
19,639. "Wireless telegraph, &c., receiving apparatus." O. E. Yeo. July 31st.
19,657. "Receivers for wireless telegraphy, &c." R. McGown. August 1st.
19,661. "Glands for electric cables." H. C. Beeston. August 1st.
19,674. "Electric terminals." E. Martin. August 1st.
19,676. "Manufacture of electric cables." G. H. Nash and Western Electric Co., Ltd. August 1st.
19,685. "Apparatus for controlling electric motors for cable haulage, &c." W. L. Hamilton. August 1st.
19,689. "Electric rheostats, &c." M. Koopman. August 1st.
19,693. "Air-brake dynamometers." B. W. Shilson and F. R. Smith. August 1st.
19,703. "Electric switches." L. Ussher. August 1st.
19,717. "Illuminated signs, &c." S. G. Joseph and Ohms, Ltd. August 1st.
19,719. "Rejector circuit for wireless telegraph, &c., reception." C. G. Lilley. August 1st.
19,720. "Thermionic valve holder." C. G. Lilley. August 1st.
19,732. "Illuminating appliances." W. A. Dorey. August 1st. (United States, June 12th.)
19,744. "Combined electric lamps and batteries." I. Jascourt, H. D. Pattinson, J. Rose, and Seal Co. London, Ltd. August 1st.
19,745. "Manufacture of basket coil's for wireless telephony, &c." E. E. Bates. August 1st.
19,750. "Electric indicators." E. W. Smith and W. G. Smith. August 1st.
19,755. "Sparking plugs." E. C. Brown. August 2nd.
19,763. "Electric fans." D. C. Anderson and T. S. Anderson. August 2nd.
19,766. "Electro-dynamic machines." F. L. Body and L. H. Body. August 2nd.
19,770. "Sparking plug." W. T. Gill and W. Strong. August 2nd.
19,774. "Switches for railways, &c." R. D. T. Alexander. August 2nd.
19,778. "Electric terminal fittings." A. E. Millard, A. E. Read, and Walsall Hardware Manufacturing Co., Ltd. August 2nd.
19,781. "Electric apparatus for generating high-frequency currents." I. Calvete. August 2nd.
19,783. "Variometer." H. B. Andrews. August 2nd.
19,784. "Apparatus for wireless telegraphy, &c." J. B. A. E. Peranne. August 2nd.
19,794. "Electric safety fuse." T. H. Koloman. August 2nd.
19,797. "Telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 2nd.
19,798. "Electric, &c., wiring." L. Ussher. August 2nd.

19,803. "Automatic wireless call device." K. L. Palmer. August 2nd.
19,809. "Burglar alarms, &c." H. C. H. Braun. August 2nd.
19,811. "Loud speaking telephones." W. Clark. August 2nd.
19,821. "Wireless telegraph, &c., receivers." Stockall, Marples & Co. (1912), Ltd., and J. J. Stockall. August 2nd.
19,836. "Electric call apparatus." C. E. Prince. August 2nd.
19,842. "Electric welding." A. E. McCarthy, H. Martin, and L. J. Steele. August 2nd.
19,861. "Telephone speaking boxes." E. L. Merrett. August 2nd.
19,878. "Electric cables." British Insulated & Helsby Cables, Ltd., J. L. Packer, and C. Vernier. August 3rd.
19,879. "Arc lamp carbon holders." W. M. France and F. Kay. August 3rd.
19,888. "Telephone receiving apparatus." R. Hope and W. G. Morgan. August 3rd.
19,898. "Electric control switches." Crompton & Co., Ltd., and W. F. Jones. August 3rd.
19,899. "Automatic drum type controllers." Crompton & Co., Ltd., and W. F. Jones. August 3rd.
19,900. "Battery control apparatus." Crompton & Co., Ltd., and W. F. Jones. August 3rd.
19,916. "Telephone receivers." Fuller's United Electric Works, Ltd., and A. P. Welch. August 3rd.
19,931. "Wireless telegraph, &c., fittings." H. E. Leigh. August 3rd.
19,933. "Electromagnetic work-fixing devices." F. Krupp Akt. Ges. August 3rd. (Germany, August 22nd, 1922.)
19,935. "Submarine telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 3rd.
19,937. "Telegraph systems." Western Electric Co., Ltd. August 3rd. (United States, August 3rd, 1922.)
19,938. "Continuously loaded signalling conductors." Western Electric Co., Ltd. August 3rd. (United States, August 3rd, 1922.)
19,939. "Electric terminals." R. E. Beswick and Radio Communication Co., Ltd. August 3rd.
19,950. "Sound-amplifying apparatus for telephones, &c." H. Ayliffe. August 3rd.
19,952. "Electric batteries." D. Pepper. August 3rd. (United States, August 7th, 1922.)
19,958. "Automatic electric sub-stations." Metropolitan-Vickers Electrical Co., Ltd. August 3rd. (United States, August 15th, 1922.)
19,968. "Electrical resistance welding." C. A. Hadley and Rose Street Foundry and Engineering Co., Ltd. August 3rd.
19,978. "Rythmic interruption of electric currents." G. Pearce and Watson & Sons (Electro-Medical), Ltd. August 3rd.
19,982. "Electrically producing ozone." Ozon-Technik Akt. Ges. August 3rd. (Germany, August 3rd, 1922.)
19,983. "Discharge tubes." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. August 3rd. (France, August 7th, 1922.)
19,998. "Audio-frequency transformers." F. Wright. August 4th.
20,000. "Wireless telegraph, &c., apparatus." C. H. Woodward. August 4th.
20,004. "Bushes for electric conduits." J. Price. August 4th.
20,020. "Dynamo-electric machines." R. Bosch Akt. Ges. August 4th. (Germany, August 12th, 1922.)
20,024. "Microphonic transmitters." E. A. Graham. August 4th.
20,025. "Microphonic transmitters." E. A. Graham. August 4th.
20,030. "Electric cable joint boxes." J. C. Lee. August 4th.
20,031. "Signalling systems." Western Electric Co., Ltd. August 4th.
20,032. "Telephone systems." Western Electric Co., Ltd. (L. Polinkowsky). August 4th.
20,050. "Battery electrolytes." E. E. Dutt and S. H. Godfrey. August 4th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

1921.

32,527. "Driving mechanism of electric generators." E. B. Collingham and C. J. A. Owen. September 5th, 1922. (200,555.)

1922.

1,358. "Vibratory device suitable particularly for sound signals." H. Baron (Signal Ges.). January 16th, 1922. (200,709.)
1,359. "Methods of, and apparatus for determining the depth of the sea." H. Baron (Signal Ges.). January 16th, 1922. (200,844.)
1,360. "Automatic telephone systems." T. Lenaghan. January 16th, 1922. (200,845.)
1,432. "Electric supply systems." Drake & Gorham, Ltd., and A. H. St. C. Watson. January 17th, 1922. (200,849.)
1,506. "Incandescent electric lamps." S. L. Price. January 17th, 1922. (200,850.)
1,791. "Leading-in wires for electric incandescent lamps, vacuum tubes and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). January 20th, 1922. (200,854.)
5,091. "Wireless telegraph receiving systems." H. J. Round. February 21st, 1922. (200,857.)
6,308. "Sparking plug." F. H. Harley. November 30th, 1922. (200,859.)
7,708. "Control of turbine-driven electrically-operated winding plant and the like." A. Stubbs and Metropolitan-Vickers Electrical Co., Ltd. March 16th, 1922. (200,869.)
7,933. "Portable electric lamps." S. J. Levi and H. Rottenburg. March 18th, 1922. (200,871.)
8,237. "Regulating arrrangements for dynamos." A. J. Jullin. March 20th, 1921. (177,522.)
8,348. "Protective systems for electric conductors." A. Reyrolle & Co., Ltd., and R. W. Biles. March 22nd, 1922. (200,876.)
10,837. "Electric heating and welding apparatus." E. Schröder. April 18th, 1922. (200,885.)
10,861. "Storage batteries." Safety Car Heating and Lighting Co. March 11th, 1922. (194,649.)
10,887. "Inductance devices." Western Electric Co., Ltd. May 21st, 1921. (180,642.)
10,907. "Connection of electric cables to electrical apparatus." F. B. Holt and Metropolitan-Vickers Electrical Co., Ltd. April 19th, 1922. (200,895.)
10,975. "Magneto-electric machines." H. Kaupmann. April 19th, 1922. (200,896.)
11,035. "Electric heating fabric." B. R. Charles. April 20th, 1922. (200,905.)
11,152. "Welding." J. Wattmann and Elektro-Thermit Ges. April 20th, 1922. (200,910.)
11,154. "Telegraphic contact-making relays." N. W. McLachlan. April 20th, 1922. (200,911.)
11,173. "Manufacture of storage-battery separators." H. Wade (Gould Storage Battery Co.). April 20th, 1922. (200,913.)
11,223. "Sparking plugs for internal-combustion engines." J. Judge. April 21st, 1922. (200,917.)
11,227. "Electrical machinery applicable more especially to squirrel-cage rotors." J. Jones. April 21st, 1922. (200,918.)
11,306. "Casings for electrical measuring instruments." Landis & Gyr Akt. Ges. April 21st, 1921. (178,859.)
11,312. "Electric lamps with light diffusing globes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 28th, 1922. (194,250.)
11,316. "Sparking plug." Fauth & Muhlberger Metallwarenfabrik (firm of) and W. Muhlberger. April 21st, 1922. (200,924.)
11,318. "Electric controllers." Electro-Mechanical Brake Co., Ltd., and M. J. Pattison. April 21st, 1922. (200,925.)
11,367. "Telegraph instruments." Siemens Bros. & Co., Ltd., and A. Gordon. April 22nd, 1922. (200,927.)
11,368. "Metering of calls in telephone systems." Siemens Bros. & Co., Ltd., D. A. Christian, and W. G. Patterson. April 22nd, 1922. (200,928.)
11,388. "Boxes for sparking plugs and the like." W. P. Fraser and J. H. Young. April 22nd, 1922. (200,930.)
11,868. "Thermal cut-outs." O. P. Cramer. April 27th, 1921. (179,178.)
11,977. "Phase-increasing apparatus employed, for example, to supply current-rectifying devices." W. H. Simms (Bureau d'Organisation Economique Soc. Anon.). April 28th, 1921. (Convention date not granted.) (179,189.)
12,144. "Dynamo lighting sets for cycles and the like." G. S. Helliwell. May 1st, 1922. (200,949.)
12,389. "Portable electric lamps, particularly intended for use in mines and other places where explosive gases are present." Watts, Fincham & Co., Ltd., and F. W. Jolly. May 2nd, 1922. (200,954.)
12,554. "Loading coils for telephone lines and the like." Forges et Ateliers de Constructions Electriques de Jeumont. March 27th, 1922. (196,337.)
12,939. "Dynamos and motors." M. W. W. Mackie. May 8th, 1922. (200,963.)
13,127. "Outlet boxes, inspection boxes, and the like for electric circuits." A. D. Clarke and P. O. Knowles, Junr. May 10th, 1922. (200,965.)
14,080. "Ignition apparatus for internal-combustion engines." B. Hopper and A. M. Lodge. May 18th, 1922. (200,973.)
14,088. "Electrical control gear." Clarke, Chapman & Co., Ltd., and R. C. Harris. May 18th, 1922. (200,974.)
14,298. "Electrical measuring instruments." D. Macadie. May 20th, 1922. (200,977.)
14,981. "Multi-layer electrical inductance coils." H. L. Thomas. May 27th, 1922. (Cognate application, 21,836/22.) (200,981.)
15,493. "Electrically-operated lifting blocks." C. L. Browne and S. H. Heywood & Co., Ltd. June 2nd, 1922. (200,989.)
16,067. "Inscribing the cases of electrical instruments." A. Oelling. June 5th, 1922. (200,993.)
16,351. "Electric furnace." A. Jones. June 13th, 1922. (200,995.)
16,443. "Elimination of overhearing or cross talk in telephone circuits." British Insulated and Helsby Cables, Ltd., F. Mercer, and W. Holttum. June 14th, 1922. (200,996.)
18,067. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th, 1922. (201,010.)
18,501. "Control of wireless amplifying apparatus." C. F. Elwell, Ltd., and B. E. G. Mittell. July 5th, 1922. (201,014.)
18,838. "Carbon holders for use with arc lamps." J. E. Phillips. April 10th, 1923. (201,019.)
19,205. "Transmission and reproduction of photographic images by means of the usual telegraphic, telephonic, and radio-telegraphic apparatus." E. Fllero and P. Ellero. July 18th, 1921. (183,135.)
19,278. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 13th, 1922. (201,026.)
20,705. "Systems of electrical distribution." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th, 1922. (201,038.)
21,044. "Ceiling mountings for electric fans." J. D. Smith and Berkeley and Young, Ltd. August 1st, 1922. (201,046.)
21,385. "Process of igniting metal-vapour electric rectifiers." Akt. Ges. Brown, Boveri et Cie. September 29th, 1921. (186,588.)
22,118. "Rotary electric ignition current distributors or timers." E. C. R. Marks (Leich Electric Co.). August 14th, 1922. (201,055.)
22,850. "Electromagnetic transmission mechanisms." A. H. Stevens (C. E. F. Ahlm). August 22nd, 1922. (201,063.)
23,607. "Electric lighter." B. J. Van Der Stigchel. August 31st, 1922. (201,067.)
23,853. "Electrical plug switches." G. Winter and R. Winter. July 31st, 1922. (Addition to 179,319.) (201,044.)
24,063. "Sparking plugs for internal-combustion engines." J. Kucharek. September 5th, 1922. (201,070.)
25,042. "Telephone systems." Western Electric Co., Ltd. September 20th, 1921. (186,333.)
26,345. "Suspension for electric lamps." A. Bonig. September 30th, 1921. (186,623.)
26,602. "Ignition devices for explosion motors." E. von Lepel. October 2nd, 1922. (Convention date not granted.) (186,918.)
26,609. "Insulators for suspended high-tension wires." A. Renaudin. October 3rd, 1921. (186,632.)
28,954. "Electric plugs." T. Klotzli. July 3rd, 1922. (200,049.)
29,117. "Devices for hermetically sealing-in glass leading-in wires for heavy electric currents." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 27th, 1922. (198,322.)
29,356. "Electromagnetic cut-outs." F. H. Royce and Rolls-Royce, Ltd. October 27th, 1922. (201,085.)
30,330. "Differentials." C. Andrade, Junr. August 25th, 1922. (201,086.)
31,634. "Thermionic valves." C. V. Morris. November 20th, 1922. (Cognate application, 34,082/22.) (201,088.)
32,081. "Electric battery lamps or lanterns." G. A. H. Wootton. November 23rd, 1922. (201,089.)
32,394. "Method of manufacturing contact banks for electromechanical telephone systems and the like." H. Baron (F. Aldendorff). July 17th, 1922. (Divided application on 19,595/22.) (201,092.)
33,616. "Clamping device for use on electrical switchboards." F. M. Madsen. December 8th, 1922. (201,099.)

1923.

160. "Control systems for electric furnaces." British Thomson-Houston Co., Ltd. (General Electric Co.). January 2nd, 1923. (201,104.)
4,121. "Electrodes for electric arc lamps for medical and other purposes." W. G. Moore. February 12th, 1923. (201,110.)
10,222. "Homopolar electric-current generators or motors." J. F. Gill and J. N. Chaviara. December 9th, 1922. (Divided application on 197,466.) (201,113.)
14,449. "Incandescent safety lamps for mines." L. E. F. Ferrette. February 23rd, 1921. (Divided application on 175,985.) (198,687.)

X-rays for Veterinary Work.—The Research Department, Woolwich, has published a description of an X-ray equipment designed and constructed at Woolwich, which has been installed in the Army Veterinary School at Aldershot (R.D. Reg. No. 56). It consists of a large teak table-top to which the animal can be strapped while in the vertical position. The X-ray tube box is mounted on a carrier which enables it to be moved into any position relative to the animal, and the examination may be made or radiographs taken with the animal in the upright position. Alternatively, the table-top may be rotated and moved on rollers so as to bring the animal into the horizontal position over a supporting table. The X-ray tube used is of the standard Coolidge type, completely enclosed for protection in a lead box, and the generating set is designed to supply up to 20 milliamperes continuously at 150,000 volts.—*Nature.*